THE

Preceptor's Assistant,

OR,

SCHOOLMASTER's GUIDE:

BEING A

COMPENDIUM OF ARITHMETIC.

Adapted to the Use of SCHOOLS.

By JOHN SHIELD,

MASTER of the ACADEMY, at EWELL, in SURRY.

CONTAINING

All the Rules of Arithmetic in whole Numbers; Vulgar and Decimal Fractions; Extraction of the Square, Cube, and Biquadrate, Roots; Duodecimals; Mensuration of Superficies and Solids; with several pleasing and useful Recreations.

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MVSEVM
BRITAN
NICVM

PREFACE.

IT will probably be expected that I should begin with an Apology for attempting to publish a Book of Arithmetic after so many learned Writers upon this Subject: But, in my Opinion, the Public should not be troubled with that Performance which stands in Need of it; for, if there is no real Merit in the Work, the Publication thereof is an Imposition which no Apology can excuse. But it is the Author's indispensable Duty to give a fair and candid Account of his Work, wherein he

differs from other Authors, and his Reason for it, that the Public may be enabled to judge whether the Performance deserves their Encouragement.

I do not presume to recommend this Treatise to an Adept in Figures, in Preference to the Works of those learned Mathematicians, Mr. MALCOLM, Mr. CLARE, and Mr. HILL, who are the best Authors extant that I have seen on practical Arithmetic: But their Works are not adapted for the Use of Schools, either in Plan or Price. My Plan, in this Treatise, has been to make it useful in Schools: Throughout the Whole, Improvement has been aimed at; and, I flatter myself, with Success.

I have adopted Mr. WALKINGAME's Method, for the greatest Part, in digesting

ing the Work, as I think his the best Treatise I have seen *for the Use of Schools*; and added several Things not in his Book; particularly a List of Copies, *English* and *French*; Receipts, Promissory Notes, and Bills of Exchange; Rules for finding the Golden Number, Epact, Moon's Age, Moon's Southing, the Dominical Letter, *&c.*

I have only to add, that the Sums, for the most Part, are new; and shall esteem the Remarks of every judicious and candid Reader as a particular Favour; at the same Time hoping they will excuse the Transposition of a Letter, or a false Figure; for, notwithstanding the Care taken in correcting, yet Errors of the Press will inevitably creep in, and some may have slipped my Observation; in either of

 which

which Cases the Admonition of an ingenious Reader will be very acceptable to his

Much obliged

And most obedient

Ewell, Surry.

Humble Servant,

JOHN SHIELD.

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TERMS of Mr. SHIELD's ACADEMY, at EWELL, in SURRY.

Successor to the late Mr. JONES, deceased.

Board, Washing, and Lodging; French, Latin, Writing, and Arithmetic; Mensuration, Surveying, and Gauging; English, and English Grammar; 16 Guineas per Annum.

Dancing Three Guineas per Ann.	Each Half a Guinea Entrance.
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N. B. Two Vacations in the Year, of a Month each, Christmas and Whitsuntide, when every young Gentleman goes Home, or pays Two Guineas if he remains at School.

Mr. SHIELD promises the greatest Attention to their Morals, and flatters himself that this reasonable and equitable Plan of Education, with some Years Experience in the most reputable Academies near Town, will recommend him to Parents and others that have young Gentlemen under their Care.

EXPLANATION of SIGNS
Used in this Compendium.

$=$ *Equal.*	The Sign of Equality; as, 4 qrs. $=$ 1 cwt. signifies that 4 qrs. are equal to 1 cwt.
$-$ *Minus*, or *less*.	The Sign of Subtraction; as, $8-2=6$; that is, 8 lessened by 2 is equal to 6.
$+$ *Plus*, or *more*.	The Sign of Addition; as, $4+4=8$; that is, 4 add 4 more is equal to 8.
$\times$ *Into*, or *with*.	The Sign of Multiplication; as, $4\times6=24$; that is, 4 multiplied into 6 is equal to 24.
$\div$ *By*.	The Sign of Division; as, $8\div2=4$; that is, 8 divided by 2 is equal to 4.
$\frac{2375}{63}$	Numbers placed like a Fraction do likewise denote Division; the upper Number being the Dividend, and the lower the Divisor.
$::$ *So is*.	The Sign of Proportion; as, $2:4::8:16$; that is, as 2 is to 4, so is 8 to 16.
$\overline{7-2}+5=10$.	Shews that the Difference between 2 and 7, added to 5, is equal to 10.
$9-\overline{2+5}=2$.	Signifies that the Sum of 2 and 5, taken from 9, is equal to 2.
$\surd$	Prefixed to any Number, signifies the Square Root of that Number is required.
$\sqrt[3]{}$	Signifies the Cube, or third Power.
$\sqrt[4]{}$	Denotes the Biquadrate, or the fourth Power, &c.

THE Preceptor's Assistant, OR, SCHOOLMASTER's GUIDE: BEING A COMPENDIUM OF ARITHMETIC.

PART I.

The INTRODUCTION.

ARITHMETIC is the Science of calculating by Figures, and consists in Theory and Practice.

The Theory examines the Nature and Quality of Figures, and demonstrates the Reason of practical Operations.

The Practice teaches the Method of working by Figures, and has five fundamental Rules for the Operations; *viz.* Notation or Numeration, Addition, Subtraction, Multiplication, and Division.

NUMERATION

Teaches the Value of Figures by their different Places, and to read or write any Sum or Number.

Table.

TABLE.

5	Hundreds of Thousands of Trillions.
5	Tens of Thousands of Trillions.
5	Thousands of Trillions.
5	Hundreds of Trillions.
5	Tens of Trillions.
5	Trillions.
5	Hundreds of Thousands of Billions.
5	Tens of Thousands of Billions.
5	Thousands of Billions.
5	Hundreds of Billions.
5	Tens of Billions.
5	Billions.
5	Hundreds of Thousands of Millions.
5	Tens of Thousands of Millions.
5	Thousands of Millions.
5	Hundreds of Millions.
5	Tens of Millions.
5	Millions.
5	Hundreds of Thousands.
5	Tens of Thousands.
5	Thousands.
5	Hundreds.
5	Tens.
5	Units.

Write down, in proper Figures, the following Numbers.

Eighty-five.

Seven hundred and fifty-nine.

Two thouſand one hundred and ſixty.

Seventy-four thouſand and nine.

One hundred and ſeven thouſand three hundred and twenty.

Six Millions five hundred and ſeventy thouſand and five.

Twenty-nine Millions three hundred and twenty thouſand and eight.

Five hundred Millions ſeven hundred and ſixteen thouſand four hundred and eighty-five.

Write down, in Words at Length, the following Numbers.

57; 436; 3005; 57486; 759864; 3754876.

Notation

Notation of Roman Letters.

I. One.
II. Two.
III. Three.
IV. Four.
V. Five.
VI. Six.
VII. Seven.
VIII. Eight.
IX. Nine.
X. Ten.
XI. Eleven.
XII. Twelve.
XIII. Thirteen.
XIV. Fourteen.
XV. Fifteen.
XVI. Sixteen.
XVII. Seventeen.
XVIII. Eighteen.
XIX. Nineteen.
XX. Twenty.
XXX. Thirty.
XL. Forty.
L. Fifty.
LX. Sixty.
LXX. Seventy.
LXXX. Eighty.
XC. Ninety.
C. A Hundred.
CC. Two Hundred.
CCC. Three Hundred.
CCCC. Four Hundred.
D. Five Hundred.
DC. Six Hundred.
DCC. Seven Hundred.
DCCC. Eight Hundred.
DCCCC. Nine Hundred.
M. A Thousand.

ADDITION

Teaches to join two or more Sums together, to make one total Sum.

RULE. Place Units under Units, Tens under Tens, &c. then add up the Units to the Top; set down the Units and carry the Tens till the last Row, at which set down the total Sum.

Addition and Subtraction Table.

1	2	3	4	5	6	7	8	9
2	4	5	6	7	8	9	10	11
3	5	6	7	8	9	10	11	12
4	6	7	8	9	10	11	12	13
5	7	8	9	10	11	12	13	14
6	8	9	10	11	12	13	14	15
7	9	10	11	12	13	14	15	16
8	10	11	12	13	14	15	16	17
9	11	12	13	14	15	16	17	18

Pence-Table.

d.		s.	d.
20	is	1	8
30	—	2	6
40	—	3	4
50	—	4	2
60	—	5	0
70	—	5	10
80	—	6	8
90	—	7	6
100	—	8	4
110	—	9	2
120	—	10	0

d.		s.
12	is	1
24	—	2
36	—	3
48	—	4
60	—	5
72	—	6
84	—	7
96	—	8
108	—	9
120	—	10

Years.	Months.	Qrs.	Cwts.	l.	l.
12345	1234	123	123	12	2
67890	5678	456	987	34	7
12345	9012	789	654	56	5
67892	3456	102	321	78	9
12345	7892	345	987	90	6
67890	1234	678	643	11	7
12345	5678	921	521	21	8
67890	9012	234	784	31	3
12345	3456	567	657	14	2
			5677		49

SUBTRACTION

Teaches to take a leſs Number from a greater, and ſhews the Remainder or Difference.

RULE. When the under Figure is leſs than the upper, put down the Difference: But, when the under exceeds the upper, add 10 to the upper, ſubtract the under from this Sum, put down the Remainder, and carry 1 to the next under Figure.

PROOF. Add the Remainder and leſs Line together.

From

From	12	942	432	5703	65432	75432
Take	10	812	123	1478	17984	12964
Remainder	2					
Proof	12					

MULTIPLICATION

Teaches how to increase the greater of two Numbers given as often as there are Units in the less, and performs the Office of many Additions.

Rule. Multiply every Figure of the Multiplicand, or biggest Number, by every Figure of the Multiplier or less Number, setting the first Figure of every Line (in the Work) under the multiplying Figure, putting down what is under or over Ten or Tens, and carrying 1 for every Ten to the next Product.

Proof. By Division.

Multiplication-Table.

2 Times	is
2	4
3	6
4	8
5	10
6	12
7	14
8	16
9	18
10	20
11	22
12	24
16	32

3 Times	is
3	9
4	12
5	15
6	18
7	21
8	24
9	27
10	30
11	33
12	36
16	48

4 Times	is
4	16
5	20
6	24
7	28
8	32
9	36
10	40
11	44
12	48
16	64

5 Times	is
5	25
6	30
7	35
8	40
9	45
10	50
11	55
12	60
16	80

6 Times	is
6	36
7	42
8	48
9	54
10	60
11	66
12	72
16	96

7 Times	is
7	49
8	56
9	63
10	70
11	77
12	84
16	112

8 Times 8 is 64	9 Times 9 is 81	10 Times 10 is 100
9 72	10 90	11 110
10 80	11 99	12 120
11 88	12 108	16 160
12 96	16 144	
16 128		
11 Times 11 is 121	12 Times 12 is 144	16 Times 16 is 256
12 132	16 192	
16 176		

Multiplicand	1207546	5000791	4756984
Multiplier	2	3	4
Answer	2415092		

3794657	45678901	41798654	64079526
5	6	7	8

749567400	4007095642847 58	40176582748659
9	11	12

When the Multiplier is more than 12, and less than 20, multiply by the Unit-Figure in the Multiplier, adding to the Product the Back-Figure to that you multiplied.

23456789	14007065	147567905	479586257
13	14	15	16

127584692	14070596	470195674	2705647059
17	18	19	19

27046987	75079645	701596428
432	8765	27004
11684298384	658073088425	18945909941712
		540769074

540769074	784569074
876543	7654321
474007346431182	6005373536068754
750967485	4109265074
23456789	649345007
17615285841505665	2668330758241385518

DIVISION

Teaches to find how often one Number is contained in another.

Rule. Find how often the Divisor, or Sum you divide by, is contained in the first Figure, or two first Figures, (if the first be too little,) of the Dividend, or Sum to be divided: Put the Quote under the partial Dividend; what remains call so many Tens, add them to the next Figure of the Dividend, then examine how often the Divisor is contained in this Sum; put the Quote under; and so proceed through all the Figures of the given Dividend. — Proof. By Multiplication or Addition.

Multiplication and Division Table.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

Dividend.
Divisor 2)798407(1 Rem.

Quotient 399203
2

Proof 798407

3)40079654 4)17096584

5)70964873 6)27984754

7)147568462 8)704965726 9)17065482

11)7027684726 12)704596728 12)70456725

Dividend.
Divisor 34)407569(11987 Quotient.
34 34
67 47948
34 35961
11 Rem.
335
306 407569
296
272
249
238
11 Rem.

3)47986459
9)15995486 — 1
1777276 — 6
3×2=6+1=7 7

27)47986459(1777276
965)147589479(152939
4737)4738101796(1000232
39007)479685472(12297
107965)478657982(4433
4096573)4096772865(1000
175967843)7046987543(92
357846921)785796475328(2195

TABLE

TABLE *of* MONEY, WEIGHTS, *and* MEASURES.

Money.

Marked.				Marked.
¼ Farthing.	4 Farthings	make	1 Penny.	d.
½ Halfpenny.	12 Pence	——	1 Shill.	s.
¾ Three Farthings.	20 Shillings	——	1 Pound.	l.

Farthings.
4 = 1 Penny.
48 = 12 = 1 Shilling.
960 = 240 = 20 = 1 Pound.

I. TROY-WEIGHT.

			Marked.
			grs.
24 Grains	make	1 Pennyweight.	dwts.
20 Pennyweights	——	1 Ounce.	oz.
12 Ounces	——	1 Pound.	lb.

Grains.
24 = 1 Pennyweight.
480 = 20 = 1 Ounce.
5760 = 240 = 12 = 1 Pound.

By this Weight are weighed Gold, Silver, Jewels, Electaries, and all Liquors.

II. AVOIRDUPOISE-WEIGHT.

			Marked.
			dr.
16 Drams	make	1 Ounce.	oz.
16 Ounces	——	1 Pound.	lb.
28 Pounds	——	1 Quarter.	qrs.
4 Quarters, or 112 lb.	——	1 Hundred Weight.	Cwt.
20 Hundred Weight	——	1 Ton	ton.

Drams.
16 = 1 Ounce.
256 = 16 = 1 Pound.
7168 = 448 = 28 = 1 Quarter.
28672 = 1792 = 112 = 4 = 1 Hundred Weight.
573440 = 35840 = 2240 = 80 = 20 = 1 Ton.

There are several other Denominations in this Weight that are used in some particular Goods: *Viz.*

A Firkin

	lb.		lb.
A Firkin of Butter –	56	A Stone of Iron, Shot, or Horseman's Wt.	14
——— Soap – –	64	——— Butchers Meat	8
A Barrel of Anchovies	30	A Gallon of Train Oil	$7\frac{1}{2}$
——— Soap – –	256	A Truss of Straw – –	36
——— Raisins – –	112	——— new Hay –	60
A Puncheon of Prunes	1120	——— old Hay –	56

A Fother of Lead, 19 Cwt. 2 qrs.

36 Trusses a Load.

Cheese and Butter.

A Clove, or Half-Stone, 8 lb.

	lb.		lb.
A Wey, in Suffolk, 32 Cloves or –	256	A Wey, in Essex, 42 Cloves or –	336

Wool.

	lb.		lb.
A Clove – – – – – – –	7	A Wey is 6 Tod and 1 Stone or – –	182
A Stone – – – – – – –	14	A Sack is 2 Weys or –	364
A Tod – – – – – – – –	28	A Last is 12 Sacks or	4368

By this Weight are weighed Things of a coarse or drossy Nature; as grocery and chandlery Ware, Bread, and all Metals, but Gold and Silver.

N. B. One Pound Avoirdupoise is equal to 14 oz. 11 dwts. $15\frac{1}{2}$ grs. Troy.

III. Apothecaries-Weight.

			Marked.
20 Grains	make	1 Scruple.	℈
3 Scruples	———	1 Dram.	ʒ
8 Drams	———	1 Ounce.	℥
12 Ounces	———	1 Pound.	℔

Grains.

20 = 1 Scruple.

60 = 3 = 1 Dram.

480 = 24 = 8 = 1 Ounce.

5760 = 288 = 96 = 12 = 1 Pound.

IV.

IV. Cloth-Measure.

				Marked.
4 Nails	make	1	Quarter of a Yard.	n. / qrs.
3 Quarters	——	1	Flemish Ell.	FE
4 Quarters	——	1	Yard.	yd.
5 Quarters	——	1	English Ell.	EE
6 Quarters	——	1	French Ell.	FE

Inches.

$2\frac{1}{4} = 1$ Nail.

$9 = 4 = 1$ Quarter.

$36 = 16 = 4 = 1$ Yard.

$27 = 12 = 3 = 1$ Flemish Ell.

$45 = 20 = 5 = 1$ Ell English.

$54 = 24 = 6 = 1$ French Ell.

V. Long Measure.

				Marked.
3 Barley Corns	make	1	Inch.	Bar. / In.
12 Inches	——	1	Foot.	Feet.
3 Feet	——	1	Yard.	Yd.
6 Feet	——	1	Fathom.	
$5\frac{1}{2}$ Yards	——	1	Rod, Pole, or Perch.	P.
40 Poles	——	1	Furlong.	Fur.
8 Furlongs	——	1	Mile.	Mile.
3 Miles	——	1	League.	Lea.
60 Miles	——	1	Degree.	Deg.

Barley-Corns

$3 = 1$ Inch.

$36 = 12 = 1$ Foot.

$108 = 36 = 3 = 1$ Yard.

$594 = 198 = 16\frac{1}{2} = 5\frac{1}{2} = 1$ Pole.

$23760 = 7920 = 660 = 220 = 40 = 1$ Furlong.

$190080 = 63360 = 5280 = 1760 = 320 = 8 = 1$ Mile.

N. B. A Degree is $69\frac{1}{2}$ Miles nearly, though commonly reckoned but 60 Miles. This Measure is used for any Thing that has Length only.

VI.

VI. Wine-Measure.

			Marked.
2 Pints - - -	make	1 Quart.	Pt. Qts.
4 Quarts - - -	——	1 Gallon.	Gal.
10 Gallons - -	——	1 Anchor of Brandy.	Anc.
18 Gallons - -	——	1 Runlet.	Run.
$31\frac{1}{2}$ Gallons - -	——	Half Hogshead.	$\frac{1}{2}$Hhd.
42 Gallons - -	——	1 Tierce.	Tierce.
63 Gallons - -	——	1 Hogshead.	Hhd.
84 Gallons - -	——	1 Puncheon.	Punch.
2 Hogsheads -	——	1 Pipe or Butt.	P. or But.
2 Pipes or 4 Hhds	——	1 Tun.	Tun.

Inches.

$28\frac{7}{8}$ = 1 Pint.

$57\frac{3}{4}$ = 2 = 1 Quart.

231 = 8 = 4 = 1 Gallon.

9702 = 336 = 168 = 42 = 1 Tierce.

14553 = 504 = 252 = 63 = $1\frac{1}{2}$ = 1 Hogshead.

19404 = 672 = 336 = 84 = 2 = $1\frac{1}{3}$ = 1 Puncheon.

29106 = 1008 = 504 = 126 = 3 = 2 = $1\frac{1}{2}$ = 1 Pipe.

58212 = 2016 = 1008 = 252 = 6 = 4 = 3 = 2 = 1 Tun.

All Brandies, Spirits, Perry, Cider, Mead, Vinegar, Honey, Oil, and Ink, are measured by this Rule.

VII. Ale *and* Beer Measure.

			Marked.
2 Pints - - - - -	make	1 Quart.	Pt. Qt.
4 Quarts - - - -	——	1 Gallon.	Gal.
8 Gallons - - - -	——	1 Firkin of Ale.	A. Firk.
9 Gallons - - - -	——	1 Firkin of Beer.	B. Firk.
2 Firkins - - - -	——	1 Kilderkin.	Kil.
2 Kilderkins - - -	——	1 Barrel.	Bar.
2 Barrels or 72 Gal.	——	1 Puncheon.	Pun.
$1\frac{1}{2}$ Barrel or 54 Gal.	——	1 Hogshead of Beer.	Hhd.
3 Barrels or 2 Hhds	——	1 Butt.	Butt.

Cubic Inches. *Beer.*

$35\frac{1}{4}$ = 1 Pint.
$70\frac{1}{2}$ = 2 = 1 Quart.
282 = 8 = 4 = 1 Gallon.
2538 = 72 = 36 = 9 = 1 Firkin.
5076 = 144 = 72 = 18 = 2 = 1 Kilderkin.
10152 = 288 = 144 = 36 = 4 = 2 = 1 Barrel.
15228 = 432 = 216 = 54 = 6 = 3 = $1\frac{1}{2}$ = 1 Hogshead.
20304 = 576 = 288 = 72 = 8 = 4 = 2 = $1\frac{1}{3}$ = 1 Punch^n.
30456 = 864 = 432 = 108 = 12 = 6 = 3 = 2 = $1\frac{1}{2}$ = 1 Butt.

Cubic Inches. *Ale.*

$35\frac{1}{4}$ = 1 Pint.
$70\frac{1}{2}$ = 2 = 1 Quart.
282 = 8 = 4 = 1 Gallon.
2256 = 64 = 32 = 8 = 1 Firkin.
4512 = 128 = 64 = 16 = 2 = 1 Kilderkin.
9024 = 256 = 128 = 32 = 4 = 2 = 1 Barrel.
13536 = 384 = 192 = 48 = 6 = 3 = $1\frac{1}{2}$ = 1 Hogshead.

In *London* they reckon but 8 Gallons to the Firkin of Ale and 32 to the Barrel; but, in all other Parts of *England*, for Ale, strong Beer, and small, 34 Gallons to the Barrel and $8\frac{1}{2}$ Gallons to the Firkin.

N. B. A Barrel of Salmon or Eels is – 42 Gallons.
A Barrel of Herrings – – – – – 32 Gallons.
A Keg of Sturgeon – – – – – 4 or 5 Gal.
A Firkin of Soap – – – – – – 8 Gallons.

VIII. Dry-Measure.

				Marked.
2	Pints – – – – –	make	1 Quart.	Pts.
2	Quarts – – – – –	——	1 Pottle.	Qts.
2	Pottles – – – – –	——	1 Gallon.	Pott.
2	Gallons – – – – –	——	1 Peck.	Gal.
4	Pecks – – – – – –	——	1 Bushel.	Pk.
2	Bushels – – – – –	——	1 Strike.	Bu.
4	Bushels – – – – –	——	1 Coom.	Ske.
2	Cooms – – – – –	——	1 Quarter.	Coom.
4	Quarters – – – –	——	1 Chaldron.	Qr.
5	Quarters – – – –	——	1 Wey.	Chal.
2	Weys – – – – – –	——	1 Last.	Wey.
				Last.

In *London* 36 Bushels make a Chaldron.

Solid Inches.

268 4/5 =	1 Gallon.							
537 3/5 =	2 =	1 Peck.						
2150 2/5 =	8 =	4 =	1 Bushel.					
4300 4/5 =	16 =	8 =	2 =	1 Strike.				
8601 3/5 =	32 =	16 =	4 =	2 =	1 Coom.			
17203 1/3 =	64 =	32 =	8 =	4 =	2 =	1 Quarter.		
86106 =	320 =	160 =	40 =	20 =	10 =	5 =	1 Wey.	
172032 =	640 =	320 =	80 =	40 =	20 =	10 =	2 =	1 Last.

The Bushel, in Water-Measure, is 5 Pecks.

A Score of Coals - - - - - is 21 Chaldrons.
A Sack of Coals - - - - - - 3 Bushels.
A Chaldron of Coals - - - - 12 Sacks.
A Load of Corn - - - - - - 5 Bushels.
A Cart-Load of Ditto - - - - 40 Bushels.

This Measure is applied to all dry Goods. The Standard Bushel is 18½ Inches wide and 8 Inches deep.

IX. Time.

			Marked.
60 Seconds - - - -	make	1 Minute.	Sec. M.
60 Minutes - - - -		1 Hour.	Hour.
24 Hours - - - - -		1 Day.	Day.
7 Days - - - - - -		1 Week.	Week.
4 Weeks - - - - -		1 Month.	Mo.
13 Months, 1 D. 6 H.		1 Julian Year.	Yr.

Seconds.

60 =	1 Minute.				
3600 =	60 =	1 Hour.			
86400 =	1440 =	24 =	1 Day.		
604800 =	10080 =	168 =	7 =	1 Week.	
2419200 =	40320 =	672 =	28 =	4 =	1 Month.

To know the Number of Days in each Month.

January - - - - - - -	31	July - - - - - - - -	31
February - - - - - -	28	August - - - - - - -	31
March - - - - - - -	31	September - - - - - -	30
April - - - - - - -	30	October - - - - - - -	31
May - - - - - - - -	31	November - - - - - -	30
June - - - - - - - -	30	December - - - - - -	31

Note.

Note. February hath 29 Days every 4th Year, called Leap-Year.

If, in dividing the Year of our Lord by 4, there is no Remainder, it is Leap-Year, in which February hath 29 Days: If there be an Overplus of 1, 2, or 3, it is the 1st, 2d, or 3d, Year after Leap-Year respectively.

X. Square-Measure.

144	Inches - - -	make 1	Foot.
9	Feet - - - -	1	Yard.
100	Feet - - - -	1	Square of Flooring.
$272\frac{1}{4}$	Feet - - - -	1	Rod.
40	Rods - - - -	1	Rood.
4	Roods - - - -	1	Acre.
640	Acres - - - -	1	Square Mile.
30	Acres - - - -	1	Yard of Land.
100	Acres - - - -	1	Hide of Land.

Inches.

144 = 1 Foot.

1296 = 9 = 1 Yard.

$39204 = 272\frac{1}{4} = 30\frac{1}{4} = 1$ Pole.

1568160 = 10890 = 1210 = 40 = 1 Rood.

6272640 = 43560 = 4840 = 160 = 4 = 1 Acre.

By this Rule all Things that have Length and Breadth, such as Land, Painting, Plastering, Flooring, Thatching, Plumbing, Glazing, &c. are measured.

XI. Solid Measure.

1728	Inches - - -	make 1	Solid Foot.
27	Feet - - - -	1	Solid Yard.

Addition *of* Money, Weights, *and* Measures.

Rule. Add the first Denomination or Row together as in Integers; divide the Sum by as many as make one of the next greater Denomination; set down the Remainder under the Row added, and carry the Quotient to the next superior Denomination, and so on to the last, at which add as in simple Addition.

Money.

£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
12	14	$6\frac{1}{2}$	16	14	$8\frac{1}{2}$	19	19	$9\frac{1}{2}$	12	12	$6\frac{1}{2}$
14	15	$0\frac{1}{2}$	14	12	$9\frac{1}{2}$	17	17	$7\frac{1}{2}$	13	13	$3\frac{1}{2}$
17	1	$9\frac{1}{2}$	13	14	$7\frac{1}{2}$	16	16	$6\frac{1}{2}$	12	19	$9\frac{1}{2}$
14	13	$5\frac{1}{2}$	12	19	$9\frac{1}{2}$	15	15	$5\frac{1}{2}$	17	17	$7\frac{1}{2}$
12	4	5	13	13	$7\frac{1}{2}$	19	18	7	18	12	$2\frac{1}{4}$
17	15	$8\frac{3}{4}$	14	14	$4\frac{1}{2}$	14	14	$4\frac{1}{2}$	14	0	$0\frac{1}{2}$
89	4	$11\frac{3}{4}$									

£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
147	16	$4\frac{1}{2}$	217	17	$9\frac{1}{2}$	147	14	$4\frac{1}{2}$	127	14	$4\frac{1}{2}$
105	13	$9\frac{1}{4}$	412	12	$9\frac{1}{2}$	137	13	$7\frac{1}{2}$	135	14	$8\frac{1}{2}$
120	12	$9\frac{3}{4}$	758	13	$4\frac{1}{2}$	127	14	$9\frac{1}{2}$	170	17	$7\frac{1}{2}$
130	12	$7\frac{1}{2}$	179	15	$7\frac{1}{2}$	123	12	$9\frac{1}{2}$	169	19	$9\frac{1}{2}$
150	16	$8\frac{1}{2}$	127	13	$9\frac{1}{2}$	167	17	$8\frac{1}{2}$	147	17	$6\frac{1}{2}$
137	18	$7\frac{1}{4}$	165	16	$7\frac{1}{2}$	470	19	$7\frac{1}{2}$	169	19	$9\frac{1}{2}$

Troy-Weight.

oz.	dwts	gr.	oz.	dwts	gr.	lb.	oz.	dwt.	lb.	oz.	dw.
7	13	14	7	19	23	7	11	14	7	10	15
9	15	10	8	14	12	9	6	17	6	6	6
7	14	8	3	14	11	8	5	14	7	7	7
6	19	12	2	13	11	7	6	19	8	8	8
4	13	23	7	15	11	8	7	14	9	9	9
7	15	21	9	13	13	9	10	19	1	1	1

Avoirdupoise-Weight.

lb.	oz.	dr.	lb.	oz.	dr.	Cwt.	qr.	lb.	Cwt	qr.	lb.
159	15	15	125	15	15	25	1	17	16	1	17
148	13	12	167	13	13	79	3	27	14	2	13
135	12	13	164	14	14	17	2	16	17	4	12
164	12	14	127	12	12	19	2	19	19	2	18
164	13	13	169	11	11	27	2	0	13	0	0
175	15	15	135	10	10	16	1	16	14	1	14

Apothecaries

Apothecaries Weight.

ʒ	℈	gr.	℥	ʒ	℈	gr.	℔	℥	ʒ	℈	℔	℥	ʒ	℈
7	1	17	9	2	1	17	7	10	7	1	7	10	2	1
4	2	6	4	1	1	16	6	9	6	1	6	9	2	1
6	0	16	3	0	0	12	7	5	4	2	7	3	2	2
9	1	12	4	1	1	13	5	8	3	2	6	5	7	1
6	1	14	5	2	1	12	7	5	4	0	4	8	4	0
7	1	15	6	0	0	0	9	6	3	2	7	9	3	2

Cloth-Measure.

EF	q.	nls.	Y.	q.	nls.	Y.	q.	nls.	EE	q.	nls.
27	2	1	35	3	3	14	3	3	72	3	2
12	1	2	16	2	2	15	2	2	13	2	1
13	2	1	17	3	3	16	3	3	12	1	1
14	1	2	18	1	1	17	2	2	14	3	2
15	2	1	19	2	2	18	3	3	17	2	1
16	1	2	20	3	3	19	1	1	13	2	1

Long-Measure.

Feet.	In.	B.C.	Yds.	Feet.	In.	M.	Fu.	P.	Leag.	M.	Fu.
27	9	2	14	2	11	27	7	39	27	2	7
16	5	1	17	1	10	16	6	35	17	1	6
17	4	2	18	2	5	17	5	16	12	1	5
18	7	1	17	1	6	18	4	18	12	1	4
14	8	1	12	1	7	19	3	14	13	2	3
15	6	2	13	1	9	17	2	36	19	2	2

Land-Measure.

A.	R.	P.	A.	R.	P.	A.	R.	P.	A.	R.	P.
74	3	27	17	1	17	17	1	19	27	1	13
16	2	30	19	1	18	16	1	14	15	1	38
14	3	35	19	2	19	13	1	16	17	2	30
16	2	17	20	1	20	12	1	13	19	1	17
15	1	11	21	1	21	17	1	17	47	1	15
17	1	17	22	2	22	16	1	16	65	1	18

Wine-Measure.

Run.	Gal.	Qts.
27	17	3
16	14	2
17	15	1
16	13	3
14	15	2
19	17	1

Tie.	Gal.	Qts.
17	17	3
14	14	1
15	15	2
19	14	3
13	12	1
19	16	2

Hhd.	Gal.	Qts.
31	57	1
14	40	3
16	14	2
45	50	1
47	19	2
36	17	1

Tun.	Hd.	Gal.
76	3	27
17	1	14
16	2	19
17	1	17
20	1	20
26	1	26

Ale and Beer Measure.

AB.	Fir.	Gal.
27	3	7
45	2	6
13	2	5
14	1	6
15	3	5
14	1	6

BB.	Fir.	Gal.
37	3	8
14	1	6
15	1	7
16	2	5
14	1	4
13	3	7

Hhd.	Gal.	Qts.
17	1	3
16	51	2
19	14	1
14	17	2
15	17	1
18	20	1

Hhd.	Gal.	Qts.
17	50	3
17	40	2
16	14	2
13	17	1
14	17	1
16	20	1

Dry-Measure.

Qrs.	Bu.	P.
75	1	3
17	7	2
14	1	1
19	6	3
14	5	1
12	4	2

Qrs.	Bu.	P.
70	1	2
16	1	3
14	1	3
15	1	1
17	1	3
17	6	2

Ch.	Bu.	P.
64	7	2
20	35	1
16	20	1
14	19	2
13	16	1
14	19	3

Ch.	Bu.	P.
40	20	1
40	14	1
70	12	2
95	17	3
17	16	1
20	14	2

Time.

Hrs.	M.	Sec.
44	59	35
14	19	17
15	14	12
13	14	15
16	17	18
19	20	21

Hrs.	M.	Sec.
19	14	17
16	14	13
12	11	10
19	18	17
16	15	14
13	12	11

W.	D.	H.
71	0	11
14	6	10
17	4	19
14	1	13
12	4	17
14	1	16

W.	D.	H.
18	3	14
17	1	12
19	1	16
14	1	17
12	2	16
19	1	19

SUBTRACTION *of* MONEY, WEIGHTS, *and* MEASURES.

RULE. Subtract as in Integers: But, if the lower Number be greater than the upper, borrow as many as make one of the next superior Denomination; add it to the upper; from which take the less, and carry 1 to the next lower Denomination from what you borrowed.

PROOF. As in Integers.

Money.

	l.	s.	d.		l.	s.	d.
Borrowed	719	14	7¼	Borrowed	459	14	2¼
Paid –	178	15	6½	Paid –	158	19	9½
Remains	540	19	0¾	Remains	300	14	4¾
Proof –	719	14	7¼	Proof –	459	14	2¼

l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.
124	17	9½	437	18	9½	235	14	7	347	15	5½
119	10	4¼	174	16	2¼	109	12	7½	109	16	6¼

Troy-Weight.

oz.	dwt.	grs.	oz.	dwt.	grs.	oz.	dwt.	grs.	lb.	oz.	dwt.	gr
14	15	11	127	14	5	457	10	9	16	4	17	20
10	13	8	109	15	16	169	14	11	10	2	19	22

Avoirdupoise-Weight.

lb.	oz.	dr.	lb.	oz.	dr.	cwt.	qrs.	lb.	T.	cwt.	qrs.	lb.
29	10	15	107	9	16	107	2	16	159	11	1	17
10	11	10	101	10	12	75	1	20	107	14	2	19

Apothecaries-Weight.

℥.	ʒ.	℈.	gr.	℥.	ʒ.	℈.	gr.	lb.	℥.	ʒ.	℈.	gr.	lb.	℥.	ʒ.	℈.	g.
25	1	2	3	15	1	1	4	49	1	1	1	3	4	7	1	2	6
10	1	1	7	10	2	2	5	15	2	2	2	4	1	9	2	2	7

Cloth-

Cloth-Measure.

EE.	qrs.	n.	yds.	qrs.	n.	yds.	qrs.	n.	EE.	qrs.	n.
35	2	1	16	3	2	17	1	1	35	1	1
16	2	2	12	3	1	11	2	2	12	2	2

Long-Measure.

F.	In.	Bar.	Yds.	F.	In.	M.	Fur.	P.	L.	M.	Fur.	P.
20	10	1	16	1	6	37	5	20	7	1	4	20
17	11	2	10	2	7	25	6	22	1	2	5	26

Land-Measure.

A.	R.	P.	A.	R.	P.	A.	R.	P.	A.	R.	P.
64	1	27	17	1	20	217	1	11	170	1	17
14	2	36	10	2	33	107	2	27	120	2	19

Wine-Measure.

run.	gal.	qts.	tier.	gal.	qts.	hhd.	gal.	qts.	tons.	hhd.	gal.
36	1	1	135	20	1	170	26	1	120	2	14
20	2	3	19	24	2	140	29	2	110	3	26

Ale and Beer Measure.

AB.	fir.	gal.	BB.	fir.	gal.	hhd.	gal.	qrts.	hhd.	gal.	qrt.
25	1	2	169	2	1	65	20	1	125	1	1
12	1	5	28	1	7	12	19	2	100	2	3

Dry-Measure.

qu.	bu.	p.	qu.	bu.	p.	qu.	bu.	p.	ch.	bu.	p.
70	1	2	60	1	2	17	1	1	165	1	2
30	1	3	25	1	3	10	2	2	120	1	3

Time.

Time.

h.	m.	s.	h.	m.	s.	m.	w.	d.	m.	w.	d.
64	1	27	15	1	30	105	1	4	17	1	3
14	14	30	12	19	35	101	2	5	10	1	5

MULTIPLICATION *of* SEVERAL DENOMINATIONS.

RULE. Multiply the lowest Denomination by the given Number; find how many Units of the next higher (given) Denomination are contained in the said Product; put down the Remainder, and carry the Units to the next Product; and so proceed.

l.	s.	d.	l.	s.	d.	l.	s.	d.	l.	s.	d.
25	14	$8\frac{1}{2}$	37	19	$6\frac{1}{4}$	47	16	$9\frac{1}{2}$	47	14	$7\frac{1}{2}$
		2			3			4			5
£51	9	5									

lb.	oz.	dwt.	gr.	tons.	cwt.	qrs.	lb.	yds.	na.	qrs.	m.	fu.	p.
7	7	16	14	25	7	1	16	40	1	2	14	6	5
			6				7			8			9

A.	R.	P.	AB.	fir.	gal.	BB.	fir.	gal.	M.	F.	P.
64	2	3	12	1	6	14	2	6	54	2	1
		2			3			4			5

18 Yds. at 4s. 6d.

			9
2×9=18	2	10	6
			2
	£.4	1	0

26 lb. Tea at £. 1 7 6

			8
	11	0	0
			3
	33	0	0
Top-Line×2	2	15	0
	£. 35	15	0

3. 33 Firkins of Butter, at £ 0 12 8½ per Firkin.
Answ. £ 20 19 9½

4. 17 Ells of Holland, at £ 0 6 4¼ per Ell.
Answ. £ 5 8 4¼

5. 35 lb. of Nutmegs, at £ 0 7 3¾ per lb.
Answ. £ 12 14 5¼

6. 85 Cwt. of Cheese, at £ 1 5 7½ per Cwt.
Answ. £ 108 16 4½

7. 47 Yards of Tabby, at £ 0 9 8½ per Yard.
Answ. £ 22 16 3½

8. 99 Dozen of Candles, at £ 0 8 4 per Dozen.
Answ. £ 41 5 0

9. 136 Gallons of Rum, at £ 0 9 6 per Gallon.
Answ. £ 64 12 0

10. 29½ Ells of Holland, at — s. 4 d. 9¾ per Ell.

		s.	d.
		4	9¾
			4
4×7=28	£ 0	19	3
			7
	£ 6	14	9
Top Line,		4	9¾
Half Top Line.		2	4⅞
	£ 7	1	11⅝

When the given Quantity is a ¼ or ½ divide the Price by a ¼ or ½; but, if ¾, divide the Price by ½, and that Quotient by ½, which add to the Product of the Quantity given.

11. 65 Ells of Diaper, - - at £ 0 1 4 per Ell.
Answ. £ 4 6 8

12. 39½ Ells of Damask, - at £ 0 5 7 per Ell.
Answ. £ 11 0 6½

13. 47¼ Cwt. of Hops, - - at £ 3 18 6 per Cwt.
Answ. £ 187 13 4½

14. 17¼ lb. of Silk, - - - at £ 0 16 10 per lb.
Answ. £ 14 10 4½

15

15. 85¾ Bushels of Wheat, – at £ 0 4 7 per Bushel.
Answ. £ 19 13 0¼

16. 19¼ Cwt. Malaga Raisins, at £ 1 4 6 per Cwt.
Answ. £ 23 11 7½

17. 108½ Yds superfine Cloth, at £ 1 0 6 per Yard.
Answ. £ 111 4 3

18. 58¾ Gallons of Rum, – at £ 0 8 6 per Gallon.
Answ. £ 24 19 4½

19. 30¾ Barrels of Herrings, at £ 3 16 9 per Barrel.
Answ. £ 116 1 8½

20. 55½ lb. of Hyson Tea, – at £ 0 18 6 per lb.
Answ. £ 51 6 9

21. 17¼ Cwt. of Cheese, – at £ 1 8 4 per Cwt.
Answ. £ 24 8 9

22. 39½ Cwt. of Tobacco, – at £ 5 7 6 per Cwt.
Answ. £ 212 6 3

23. 46¾ Cwt. of Currants, – at £ 2 18 6 per Cwt.
Answ. £ 136 14 10½

Division *of* several Denominations.

Rule. – Divide the first Denomination on the left Hand; and, if any remain, multiply them by as many of the next less as make one of that, which add to the next, and divide as before. – – –

Proof. – By Multiplication.

	£	s.	d.
2)	27	3	4
	13	11	8

	£	s.	d.
3)	47	16	8

	£	s.	d.
4)	50	14	4½

	£	s.	d.
5)	39	17	7½

	lb.	oz.	dw.	gr.
6)	75	10	13	4

	lb.	oz.	dr.
7)	45	14	12

	T.	Cw.	gr.	lb.
8)	13	19	1	14

	Yds	qr.	na.
9)	74	1	3

	M.	Fur.	P.
11)	72	3	26

	Ch.	Bu.	P.
12)	15	3	1

BILLS

BILLS OF PARCELS, RECEIPTS, PROMISSORY NOTES, &c. &c.

Hosier's.

Sir *William Fashion*

Bought of *William Carpenter, Jan.* 10, 1780.

		s.	d.		£	s.	d.
6 Pair of Silk Stockings, –	at	14	6	per Pair,	4	7	0
4 Pair of Thread Ditto, –	at	3	6	———	0	14	0
6 Pair of Worsted, ribbed,	at	4	6	———	1	7	0
4 Pair of Cotton Ditto, – –	at	5	0	———	1	0	0
2 Pair of black Silk, – –	at	12	6	———	1	5	0
2 Pair ditto Worsted, – –	at	5	6	———	0	10	0
					£9	3	0

Mercer's.

Lady *Fashion*

Bought of *Timothy Weaver, Sept.* 9, 1779.

		s.	d.		£	s.	d.
12 Yards of flowered Silk, –	at	17	6	per Y.	9	18	0
14 Yards of rich Brocade, –	at	18	6	———	12	19	0
9 Yards of Sattin, – –	at	12	6	———	5	12	6
12 Yards of Sarsenet, – – –	at	4	6	———	2	14	0
20 Yards of Lustring, – – –	at	6	6	———	6	10	0
10 Yards of *Genoa* Velvet, –	at	28	6	———	14	5	0
					£51	18	6

Linen-Draper's.

Mrs. *Easy*

Bought of *Charles Hammond, July* 10, 1779.

		s.	d.		£	s.	d.
5 Yards of Cambric, – –	at	11	6	per Y.	2	17	6
12 Yards of Muslin, – – –	at	10	8	———	6	8	0
21 Yards of printed Linen, –	at	3	9	———	3	18	9
3 Dozen of Napkins, – –	at	2	0	each	3	12	0
10 Ells of Diaper, – – – –	at	1	9	per Ell	0	17	6
14 Ells of Dowlas, – – – –	at	1	2½	———	0	16	11
					£18	10	8

Woollen-Draper's.

Mr. *Lane*

Bought of *Thomas Woolsack*, *Aug.* 8, 1779.

		s.	d.		£	s.	d.
12 Yards of fine Serge, - -	at	4	6	per Y.	2	14	0
12 Yards of Drugget, - -	at	10	0	———	6	0	0
7 Yards of fine Scarlet, - -	at	21	0	———	7	7	0
9 Yards of *Manchester* Stuff,	at	11	6	———	5	3	6
17 Yards of *Manchester* Velvet,	at	24	0	———	20	8	0
12 Yards of Drab, - - - -	at	16	6	———	9	18	0
					£51	10	6

Milliner's.

Mrs. *Freeman*

Bought of *Lucy Careful*, *April* 5, 1779.

		£	s.	d.		£	s.	d.
12 Yards of fine Lace, -	at	0	5	9	per Yd.	3	9	0
2 Doz. fine Kid Gloves,	at	0	2	3	per Pair,	2	14	0
12 Fans, - - - - - - -	at	0	4	6	each, -	2	14	0
4 Fine laced Tippets,	at	4	0	0	each, -	16	0	0
20 Yds of pink Ribband,	at	0	2	0	per Yd.	2	0	0
4 Dozen of *Irish* Lamb,	at	0	1	4	per Pair,	3	4	0
						£30	1	0

Grocer's.

Mr. *Grovenor*

Bought of *James Plumb* & Co. *Aug.* 9, 1779.

		£	s.	d.		£	s.	d.
3 Loaves of double refined Sugar, wt. 17 lb. each,	at	0	1	2	pr lb	2	19	6
¼ Hundred of Rice, - - -	at	0	19	0	pr cwt	0	4	9
½ Hundred Malaga Raisins,	at	3	10	0	pr cwt	1	15	0
½ Hundred of Currants, - -	at	3	10	0	pr cwt	1	15	0
7 lb. of black Pepper, - -	at	0	1	9	pr lb	0	12	3
6 lb. of fine Green Tea, - -	at	0	12	0	pr lb	3	12	0
						£10	18	6

Leather-Seller's.

Mr. *Skimpton*

Bought of *James Hide* & Co.

August 12, 1779.		*s.*	*d.*		£	*s.*	*d.*
25 Calf Skins, - - - - - -	at	3	6	pr Sk.	4	7	6
100 Sheep Skins, - - - - -	at	1	2	——	5	16	8
50 Coloured Ditto, - - - -	at	1	4	——	3	6	8
15 Russia Hides, - - - - -	at	17	6	each.	13	2	6
20 Buck Skins, - - - - - -	at	12	6	——	12	10	0
20 Fine Ditto, - - - - - -	at	14	6	——	14	10	0
				£	53	13	4

Wine-Merchant's Bill.

Mr. *Tempest*

Bought of *James Pipestave* and Co.

Jan. 19, 1779.

		£	*s.*	*d.*		£	*s.*	*d.*
4 Dozen best Mountain,	at	1	2	0	pr D.	4	8	0
2 Ditto Lisbon, - - - -	at	1	1	0	——	2	2	0
6 Dozen best Madeira, -	at	1	12	0	——	9	12	0
12 Dozen of Red Port, -	at	1	1	6	——	12	18	0
6 Gallons of Rum, - - -	at	0	10	0	——	3	0	0
12 Gal. of French Brandy,	at	0	14	0	——	8	8	0
					£	40	8	0

The Form of a Bill, if a yearly Account.

Mr. *Colebrook*

Debtor to *James Elphinston* & Co.

1779.			£	*s.*	*d.*		£	*s.*	*d.*
Jan. 20,	2 Doz. Port Wine,	at	1	1	0	per D.	2	2	0
Mar. 9,	4 Ditto, - - - -	at	1	1	0	——	4	4	0
—— 16,	1 Ditto, - - - -	at	1	1	0	——	1	1	0
July 20,	4 Gal. of Brandy,	at	0	14	0	per G.	2	16	0
Nov. 9,	2 Doz. white Port,	at	1	2	0	per D.	2	4	0
Dec. 20,	4 Ditto red Ditto,	at	1	1	0	——	4	4	0
						£	16	11	0

Receipts.

1. Received, *August* 20, 1779, of Mr. *James*, Twelve Pounds Ten Shillings and Sixpence, in full of all Demands. *Jacob Hemit.*

2. Received of Mr. *James Staples*, *July* 7, 1779, Twenty Pounds Four Shillings and Sixpence, on Account. *John Croft.*

3. Received, *July* 9, 1779, of Mr. *Gibbs*, Twenty-seven Pounds Four Shillings, in full of all Demands, for *William Bland* and self. *Joseph Crisp.*

4. Received, *October* 20, 1779, of Mr. *Lamb*, Six Pounds Nine Shillings and Sixpence, for self and Co.
£ 6 9 6 *William Bland.*

5. Received, *August* 12, 1779, of Mr. *Brooks*, One Pound Seventeen Shillings, for 1 Quarter's Salary, or Wages, due Midsummer last. *Mary Drudge.*

6. Received, *September* 9, 1779, of *James Foot*, Esq. Forty Pounds Ten Shillings, in full of all Demands, for my Father. *Stephen Frost.*

Promissory Notes.

A Promissory Note is a written Paper, containing a Promise to pay a Sum of Money at a certain Time specified.

Promissory Notes, payable to Order, are indorsable from one Person to another.

Promissory Notes and Book-Debts, if not legally demanded in six Years, cannot be recovered by Law.

London, *Jan.* 9, 1779.

I promise to pay Mr. *Crampton*, or Bearer, on Demand, Thirty Pounds Fourteen Shillings and Sixpence, Value received. *Jephtha Jones.*

I promise to pay *James Grant*, Esq. or Order, three Months after Date, Ninety-six Pounds Seven Shillings, Value received.

Aug. 30, 1779. *George Wainwright.*

London, July 2, 1779.

I promise to pay Mr. *B.* or Order, Twenty Pounds, on Demand, for Sir *James Hart* and Co.

£ 20 *Humphry Smart.*

Notes under five Pounds must be witnessed, to stand good in Law.

INLAND *and* FOREIGN BILLS *of* EXCHANGE.

Sir, £ 17 8 *Bristol, July 14, 1779.*

At Sight, pay Mr. *William Jubb*, Seventeen Pounds Eight Shillings, Value received of Sir *James Blunt*, and place it to Accompt, as by Advice from yours,

To *Robert Rowland.*

Alderman Lewin,
London.

London, June 12, 1779, for 790 Crowns, at Usance.

London on Calais, first Bill. At Usance, pay this first of Exchange to Captain *Granby*, or Order, Seven Hundred and Ninety Crowns, for the Value here received of Sir *William Tempest*, and place it to Account, as *per* Advice from

To *Prescot and Gower.*

Mr. James Manly,
Merchant, in Calais.

Sir, £ 18 8 6 *Salisbury, July 9, 1779.*

Payable after Date. Twenty Days after Date, pay *John Cole* Eighteen Pounds Eight Shillings and Sixpence, Value received of Mr. *James Gibbs*, and place it to Account, as *per* Advice from yours,

To *Jacob Jones.*

George Jefferies,
Bucklersbury.

London, June 12, 1779, for 790 Crowns, at Usance.

Second Bill. At Usance, pay this my second of Exchange, my first not paid, to Captain *Granby*, or Order, Seven Hundred and Ninety Crowns, for

for the Value here received of Sir *William Tempest*, and place it to Account, as *per* Advice from

To *Prescot and Gower*.

[*James Manly*,
Merchant, *Calais*.

FORM *of a* WILL.

From Mr. Clare's Introduction to Trade and Business.

In the Name of God. Amen.

I, [the Lady *Arabella Earnly*,] of [*Bromley*, in the County of *Kent*, Widow,] being in perfect Mind and Memory, make this my last Will and Testament. First, I desire to be buried [in the Parish-church of St. *Anne*, in the Liberty of *Westminster*, and that the Charges of my Funeral may not exceed forty Pounds.] My temporal Estate I bequeath and dispose of in the following Manner. *Imprimis*, [to my Daughter *Alice* I bequeath the Sum of two thousand five hundred Pounds, my *Indian* Trunk, a Table-clock, and my Picture done by *Dahl*. *Item*, [to my Niece and God-daughter, *Mary Peters*, I bequeath my Diamond-ring, my Pearl Pendants set with Brilliants, and a hundred Pounds to buy her Mourning.] *Item*, [to Mr. *William Vernon*, my Cousin, I bequeath the Sum of one Guinea, to buy him a Ring.] *Item*, [to the Poor of the Parish of *Bromley* aforesaid, I bequeath the Sum of ten Pounds, to be paid to the Minister and Church-wardens within ten Days after my Funeral, to be by them distributed, as they see good, among their said Poor.] The Residue and Remainder of my Estate, Lands, Tenements, Hereditaments, with my Goods, Chattels, Plate, and Jewels, *India* Bonds, Arrears of Rent, with all other Properties, of what Kind soever, to me appertaining, I give, devise, and bequeath, [to my Son *Thomas*;] whom I constitute and appoint [the whole and sole] Executor of this my last Will and Testament. And I do hereby utterly revoke, disallow, and disannul, all former Bequests, Wills, and Legacies, by me heretofore in any Wise left or made; declaring, ratifying, and confirming, this and no other to be my last Will and Testament. In Witness whereof I have hereunto set my

 Hand

Hand and Seal, this [twelfth Day of *May*, in the Year of our Lord One Thousand Seven Hundred and Fifty-one.]

[*Arabella Earnly*.]

Signed, sealed, published, and declared, by the [Testatrix,] as and for [her] last Will and Testament, in Presence of us, who, at [her] Request, in [her] Presence, and in the Presence of each other, have subscribed our Names as Witnesses thereto.

C. D.
E. F.
G. H.

N. B. Three Witnesses are requisite to a Will if it concern a real Estate; which Witnesses are to see the Testator sign it, as well as each other. If the Estate be personal only, two are sufficient.

The Law exempts Wills from being made on stamped Paper.

REDUCTION.

To reduce a Number of the higher of two Denominations to an Equivalent of the lower, multiply by the Number of the lower in an Unit of the higher.

To reduce a Number of the lower of two Denominations to an Equivalent of the higher, (or to find how often an Unit of the higher is contained in it,) divide by the Number of the lower in an Unit of the higher.

I. Reduction descending.

N. B. A Mark is 13s. 4d. A Noble is 6s. 8d.
An Angel – 10 0 A Groat – 0 4

In

In £ 13 how many Shillings, Pence, and Farthings?

```
   20
  ----
  260 Shillings.
   12
  ----
 3120 Pence.
    4
  ----
12480 Farthings.
  ----
```

In 17 Pounds how many Shillings and Pence?
Answ. 340s. 4080d.

In £. 19 14 how many Farthings?
Answ. 18912 Farthings.

In 175 Guineas how many Pence?
Answ. 44120 Pence.

In 1750 l. how many Crowns? — *Answ.* 7000 Crowns.

In 1729 Guineas how many Crowns?
Answ. 7261 Crowns, and 4 Shillings over.

In 7500 Guineas how many Angels and Nobles?
Answ. 15750 Angels 23625 Nobles.

In 75 Guineas how many Shillings, Pence, and Farthings?
Answ. 1575 Shil. 18900 Pence 75600 Farth.

In 706 Pounds how many Marks, Angels, and Nobles?
Answ. 1059 M. 1412 Ang. 2118 Nobles.

In 750 Marks how many Pence? — *Answ.* 120000 d.

In £ 750 16 8¼ how many Farthings?
Answ. 720803 Farthings.

In 17 Crowns how many Shillings and Sixpences?
Answ. 85 Shillings 170 Sixpences.

In 750 Guineas how many Crowns, Half-Crowns, Shillings, and Pence, and of each an equal Number?
Answ. 1834 of each, and 98 d. over.

In £ 4567 how many Shillings, Pence, and Farthings?
Answ. 91340 Shill. 1096080 Pence 4384320 Farth.

In 20 Guineas how many Nobles? — *Answ.* 63 Nobles.

Reduction ascending.

In 12480 Farthings how many Pounds?

4)12480

4)12480 Farthings.

12)3120 Pence.

20)26|0 Shillings.

£ 13 Pounds.

In 179645 Farthings how many Pence, Shill. and Pounds? *Answ.* 44911 d. 3742 s. £ 187 2 7¼

In 3459 Pence how many Pounds? — *Answ.* £ 14 8 3

In 3579 Shillings how many Pounds? *Answ.* £ 178 19 0

In 1750 Half-Crowns how many Pounds? *Answ.* £ 218 15 0

In 9507 Crowns how many Pounds? *Answ.* £ 2376 15 0

In 17046 Sixpences how many Pounds? *Answ.* £ 426 3 0

In 17540 Three-pences how many Shillings and Guineas? *Answ.* 4385 Shill. 208 Guin. and 17 Shill.

In 3456 Nobles how many Pounds? — *Answ.* £ 1152.

In 1750 Marks how many Pounds? *Answ.* £ 1166 and 13 s. 4 d. over.

In 1296 Angels how many Guineas? *Answ.* 617 Guineas and 3 Shillings over.

In 2740 Groats how many Pounds? — *Answ.* £ 45 13 4

In 3549 Pence how many Guineas, Crowns, Nobles, Shillings, and Pence, and of each an equal Number? *Answ.* 8 of each, and 309 Pence over.

Reduction ascending *and* descending.

In 1740 Pence how many Crowns and Shillings?

6|0)174|0

29 Crowns.

5

145 Shillings.

In 7494 Pence how many Crowns and Shillings?
Answ 124 Cr. and 54 d. over, 624 s. and 6 d. over.
In 4579 Shillings how many Half-Crowns and Groats?
Answ. 1831 Half-C. and 18 d. over, 13737 Groats.
In £ 63 how many Half-Crowns, Shillings, and Guineas?
Answ. 504 Half-C. 1260 Shill. and 60 Guineas.
In £ 96 17 4 how many Shillings and Marks?
Answ. 1937 s. and 4 d. over, 145 Marks and 4 s. over.
In £ 200 how many Shillings, Half-Crowns, and Crowns, and of each an equal Number?
Answ. 470 of each, and 5 Shillings over.
In £ 80 how many Crowns, Half-Crowns, Three-pences, Groats, and Shillings?
Ans. 320 Cr. 640 H.C. 1600 Sh. 4800 Gr. 6400 Thr.
A Man had 27 Purses, and in each a Guinea, Mark, Noble, Crown, and Half-Crown, how many Pounds sterling had he in all? *Answ.* £ 65 9 6
In 40 Guineas, as many Pounds, Marks, and Half-Crowns, how many Pence? *Answ.* 27280 Pence.
In £ 17 8 4 how many Crowns and Half-Crowns, and of each an equal Number?
Answ. 46 of each, and 3 s. 4 d. over.
In £ 20 how many Half-Crowns, Three-pences, and Groats? — *Answ.* 160 H.C. 1600 Thr. 1200 Groats.

Troy-Weight.

In 27 oz. of Gold how many Grains? — *Ans.* 12960 gr.
In 17528 Grains how many Ounces?
Answ. 36 oz. 10 dwts. 8 gr.
In 3 lb. 4 oz. 6 dwts. 5 gr. how many Grains?
Answ. 19349 Grains.
In 7 Ingots of Silver, each weighing 6 lb. 5 oz. 14 dwts. 19 gr. how many Ounces, Pennyweights, and Grains?
Answ. 544 oz. 10883 dwts. 261205 gr.
In 12960 Grains how many Ounces? — *Answ.* 27.

A Goldsmith had 245 lb. 3 oz. 6 dwts. 9 gr. of Silver, and wanted to make it into Tankards of 16 oz. 13 dwts. 10 gr. Spoons of 25 oz. 11 dwts. 13 gr. *per* doz. Salts of 5 oz. 10 dwts. 4 gr. each, Forks of 22 oz. 11 dwts. 15 gr. *per* doz. and for every Tankard to have one Salt, a Dozen of

of Spoons, and a Dozen of Forks; what is the Number of each he must have?

Answ. 3 of each, and 16467 Grains over.

Avoirdupoise-Weight.

16 Ounces make - - - -	1 common Pound.
24 Ounces - - - - - -	1 great Pound.
12 Pieces of Things - -	1 Dozen.
12 Dozen - - - - - -	1 Gross.
12 Gross or 144 Dozen -	1 great Gross.

In 17 cwt. 3 qrs. 15 lb. how many Pounds?

```
 17          17  3  15
 17           4
 17          ----
1799          71
----          28
2003 lb.     ----
----          583
              142
             ----
             2003
             ----
```

In 75458 Ounces how many Hundred-Weight?

Answ. 42 cwt. 0 qr. 12 lb. 2 oz.

In 145 cwt. how many Ounces? — *Answ.* 259840 oz.

Bought 50 Bags of Hops, each 3 cwt. 1 qr. 14 lb. and another of 250 lb. how many Hundred-Weight in the Whole? *Answ.* 170 cwt. 3 qr. 26 lb.

In 55 cwt. how many Parcels of 33 lb. each?

Answ. 186 Parcels, 22 lb. over.

In 17 cwt. 3 q. 15 lb. of Indigo how many Pounds?

Answ. 2003 lb.

In 340 Great Pounds how many Common? — *Ans.* 510.

In 510 Common Pounds how many Great? — *Ans.* 340.

How many Parcels of Tobacco, of 19 lb. 3 oz. are there in 7 cwt. 1 q. 14 lb.?

Answ. 43 Parcels, 15 oz. over.

Tare,

Tare, Trett, and Cloff,

Are the Allowances usually made in this Weight.

Tare is an Allowance to the Buyer for the Weight of the Box, Barrel, or Bag, &c. Trett is an Allowance of 4 lb. in 104 lb. for Waste; made to the Buyer. Cloff is an Allowance of 2 lb. on every Draught above 3 cwt. on some Sorts of Goods. Gross Weight is the whole Weight, without any Deduction. Suttle is when Part of the Allowance is deducted from the Gross. Neat Weight is the pure, after all Deductions.

Rule. When the Tare is at so much *per* Bag, Barrel, &c. multiply the Number of Bags, &c. by the Tare, and subtract the Product from the Gross; the Remainder is Neat. *Note*, to reduce Pounds to Gallons, multiply by 2, and divide by 15.

Examples.

In 7 Trails of Raisins, each weighing 4 cwt. 2 qrs. 17 lb. Gross, Tare 16 lb. *per* Trail, how much Neat Weight? *Answ.* 3535 lb.

In 130 Barrels of Indigo, each 4 cwt. 2 qrs. 17 lb. Gross, Tare 45 lb. *per* Barrel, how many Pounds Neat? *Answ.* 61880 lb.

In 17 Bags of Hops, each 2 cwt. 1 qr. 4 lb. Gross, Tare *per* Bag 19 lb. how many Pounds Neat? *Answ.* 4029 lb.

In 14 Bags of Pepper, each 75 lb. 5 oz. Gross, Tare *per* Bag 3 lb. 5 oz. how many Pounds Neat? *Answ.* 1008 lb.

Rule. When the Tare is at so much in the whole Gross Weight, subtract the given Tare from the Gross; the Remainder is Neat.

What is the Weight of 5 Hogsheads of Tobacco, weighing Gross 85 cwt. 1 qr. 15 lb. Tare in the Whole 396 lb.? *Answ.* 81 cwt. 3 qr. 11 lb.

In 79 Barrels of Figs, each 2 qrs. 25 lb. Gross, Tare in the Whole 569 lb. how much Neat Weight? *Answ.* 52 cwt.

In

In 25 Hogsheads of Sugar, each weighing 10 cwt. 3 qrs. 14 lb. Gross, Tare in the Whole 965 lb. how many Hundred-Weight Neat? — *Answ.* 263 cwt. 1 qr. 1 lb.

In 35 Bags of Hops, each weighing 3 cwt. 1 qr. 14 lb. Gross, Tare in the Whole 220 lb. how many Pounds Neat? *Answ.* 95 cwt. 0 qr. 16 lb.

RULE. When the Tare is at so much *per Cent.* divide the Gross Weight by the aliquot Parts of a Cwt. which subtract from the Gross; the Remainder is Neat.

Note. 7 lb. is $\frac{1}{16}$, 8 is $\frac{1}{14}$, 14 is $\frac{1}{8}$, 16 is $\frac{1}{7}$, of a cwt.

What is the Neat Weight of 12 Butts of Currants, each weighing 7 cwt. 1 qr. 14 lb. Tare at 15 lb. *per Cent.*? *Answ.* 76 cwt. 2 qrs. 16 lb. 8 oz.

In 35 Barrels of Figs, each weighing 3 cwt. 1 qr. 17 lb. Gross, Tare *per Cent.* $19\frac{1}{2}$ lb. how many Cwt. Neat? *Answ.* 98 cwt. 1 qr. 9 lb. 4 oz. 8 dr.

In 7 Hogsheads of Sugar, each 12 cwt. 1 qr. Gross, Tare *per Cent.* 35 lb. how much Neat Weight?

Answ. 58 cwt. 3 qr. 22 lb. 12 oz.

In 35 Barrels of Indigo, each 3 cwt. 1 qr. 4 lb. Gross, Tare per Cent. $10\frac{1}{2}$ lb. how much Neat Weight?

Answ. 104 cwt. 0 qr. 24 lb. 8 oz.

RULE. When Trett is allowed with Tare, divide the Pounds Suttle by 26; the Quotient is the Trett; which subtract from the Suttle, the Remainder is Neat.

In 2 Hogsheads of Sugar, each weighing 12 cwt. 1 qr. 17 lb. Gross, Tare 11 lb. *per Cent.* Trett 4 *per* 104 lb. how much Neat Weight?

Answ. 21 cwt. 2 qrs. 0 lb. 15 oz. 9 dr.

In 4 Hogsheads of Tobacco, each weighing Gross 3 cwt. 3 qrs. 2 lb. Tare 8 lb. *per Cent.* Trett 4 *per* 104, how much Neat Weight? — *Answ.* 13 cwt. 1 qr. 23 lb.

In 7 Barrels of Figs, each 2 cwt. 2 qrs. 2 lb. Gross, Tare 140 lb. Trett 4 lb. *per* 104, how much Neat Weight?

Answ. 15 cwt. 2 qrs. 27 lb.

In 25 Butts of Currants, each weighing 9 cwt. 3 qrs. 5 lb. Gross, Tare $19\frac{1}{2}$ *per Cent.* Trett 4 lb. *per* 104, how much Neat Weight?

Answ. 194 cwt. 1 qr. 22 lb. 15 oz. $4\frac{1}{4}$ dr. nearly.

RULE.

RULE. When Cloff is allowed, multiply the Cwt. Suttle by 2, divide the Product by 3, the Quotient will be the Pounds Cloff; which subtract from the Suttle, the Remainder is Neat.

What is the Neat Wt. of 5 Hhds of Sugar, each weighing 10 cwt. 1 qr. 15 lb. Tare 17 lb. per cent. Tret 4 lb. per 104, Cloff 2 lb. for 3 cwt. *Answ.* 41 cwt. 3 qr. 11 lb.

How much Neat Wt. is 19 cwt. 1 qr. 5 lb. Gross, Tare 140 lb. Tret 4 lb. per 104, Cloff 2 lb. in 3 cwt. *Answ.* 17 cwt. 1 qr.

APOTHECARIES WEIGHT.

In 37 ℔ 5 ℥ 2 ʒ 1 ℈ 2 gr. how many Grains? *Answ.* 209902 Grains.

In 209902 Gr. how many Pounds, Ounces, Drachms, Scruples, and Grains? *Answ.* 37 ℔ 5 ℥ 2 ʒ 1 ℈ 2 gr.

CLOTH-MEASURE.

In 29 Yards how many Nails? *Answ.* 464 Nails.

In 47 Ells English how many Yards? *Answ.* $58\frac{3}{4}$ Y.

In $79\frac{3}{4}$ Yards how many Ells Flemish? *Answ.* $106\frac{1}{3}$ E.

In 7 Pieces of Cloth, each 29 Ells Flemish, how many Yards? *Answ.* $152\frac{1}{4}$ Yards.

In 25 Bales of Cloth, each 20 Pieces, each 17 Ells English, how many Ells Flemish? *Answ.* $14166\frac{2}{3}$ E.F.

In 464 Nails how many Yards? *Answ.* 29 Yards.

In $58\frac{3}{4}$ Yards how many Ells English? *Answ.* 47 E.E.

In $106\frac{1}{3}$ Ells Flemish how many Yards? *Answ.* $79\frac{3}{4}$ Y.

In $152\frac{1}{4}$ Yards how many Ells Flemish? *Answ.* 203 E.F.

In $14166\frac{2}{3}$ Ells Flemish how many Ells English? *Answ.* 8500 Ells Eng.

LONG MEASURE.

In 69 Miles how many Furlongs and Poles? *Answ.* 552 F. 22080 P.

In 6 Leagues how many Feet, Inches, and Barley-Corns? *Answ.* 95040 F. 1140480 I. 3421440 B. C.

In 72 Miles how many Feet? *Answ.* 380160 F.

If, from *London* to *Edinburgh* be accounted 134 Leagues, I demand how many Miles, Yards, Feet, Inches, and Barley Corns? — *Answ.* 402 M. 707520 Y. 2122560 F. 25470720 I. 76412160 B. C.

How many Barley-Corns will reach round the Moon, which is supposed to be 98 Degrees, 1 Mile, 383 Yards, 23 Inches, and 1 Barley-Corn, in Circumference?

Answ. 1294866934 B. C.

In 7983360 Barley-Corns how many Leagues?

Answ. 14 L.

In 648279 Yards how many Miles?

Answ. 368 M. 599 Y. over.

In 75486 Inches how many Furlongs?

Answ. 9 F. 21 P. 1 Y. 1 F.

Land-Measure.

In 35 Acres how many Roods and Poles?

Answ. 140 R. 5600 P.

How many Poles are contained in 7 Fields: The 1st containing 3 Acres, 5 Roods; the 2d. 4 Acres, 4 Rods; the 3d. 9 Acres, 7 Perches; the 4th. 3 Acres, 4 Roods, 9 Poles; the 5th, 6th, and 7th, 3 Acres, 1 Rood, 7 Rods, each. *Answ.* 5001 Poles.

In 7548695 Poles how many Acres?

Answ. 47179 A. 1 R. 15 P.

In 5600 Poles how many Acres? *Answ.* 35 A.

In 5001 Poles how many Acres? *Answ.* 31 A. 1 R. 1 P.

Wine-Measure.

In 5 Tuns of Wine how many Gallons? *Answ.* 1260 G.

In 1260 Gallons how many Tuns? *Answ.* 5 T.

In 17 Pipes of Wine how many Quarts? *Answ.* 8568 Q.

In 8568 Quarts how many Pipes? *Answ.* 17 P.

In 59648 Gallons of Lisbon how many Pipes and Hogsheads, and of each a like Number?

Answ. 315 of each, and 113 Gal. over.

In $75\frac{1}{2}$ Anchors of Brandy how many Pints?

Answ. 6040 P.

In 6040 Pints of Brandy how many Anchors? *Answ.* $75\frac{1}{2}$.

In 17 Tierces how many Quarts? *Answ.* 2856 Q.

In 2856 Quarts how many Tierces? *Answ.* 17 T.

Ale

Ale *and* Beer Measure.

In 57 Barrels of Beer how many Pints? *Answ.* 16416 P.
In 16416 Pints how many Barrels? *Answ.* 57 B.
In 17 Barrels of Ale how many Gallons and Quarts? *Answ.* 544 G. 2176 Q.
In 2176 Quarts how many Gallons and Barrels? *Answ.* 544 G. 17 B.
In 72 Hogsheads of Beer how many Gallons? *Answ.* 3888 G.
In 3888 Gallons how many Hogsheads? *Answ.* 72 H.
In 7 Hogsheads of Beer how many Barrels? *Answ.* $10\frac{1}{2}$ B.
In $10\frac{1}{2}$ Barrels of Beer how many Hogsheads? *Answ.* 7 H.

Dry-Measure.

In 50 Quarters of Wheat how many Bushels, Pecks, Gallons, and Quarts? *Answ.* 400 B. 1600 P. 3200 G. 12800 Q.
In 50 Chaldron of Coals how many Pecks? *Answ.* 7200 P.
In 396 Lasts of Corn how many Pecks? *An.* 126720 P.
In 126720 Pecks of Corn how many Lasts? *An.* 396 L.
In 7200 Pecks of Coals how many Chaldron? *Answ.* 50 C.
In 12800 Quarts of Wheat how many Quarters? *Answ.* 50 Q.

Time.

In 75864 Hours how many Weeks? *Answ.* 451 W. and 4 Days over.
In 37984 Hours how many Days? *An.* 1582 D. 16 H.
How many Hours is it since the Creation of the World to Christmas, 1779; if Christ was born *Anno Mundi* 4000? *Answ.* 50658714 H.
From *September* 9, 1745, to *February*, 17, 1746, how many Days? *Answ.* 161 D.
In 451 Weeks and 4 Days how many Hours? *Answ.* 75864 H.

In 1582 Days how many Hours? *Answ.* 37968 H.
In 50658714 Hours how many Years? *Answ.* 5779Y.

THE RULE OF THREE DIRECT

Teaches by three given Numbers to find out a fourth, in such Proportion to the third as the second is to the first.

RULE. The first and third Terms must be of one Name, and the second the same as the Number required; multiply the second and third Terms together, and divide by the first, the Quotient will be the Answer to the Question, in the same Denomination you left the second Number in.

EXAMPLES.

If 1 lb. of Sugar cost 6d. what will 1 cwt. cost?
Answ. £2 16 0

1lb. —— 6d. —— 1 Cwt.
4
——
4
28
——
112
6
——
12)672
——
2|0)5|6
——
£2 16 0

If 1 lb. of Tobacco cost 2s. 6d. what will 96 lb. cost?
Answ. £12 0 0

If 96lb. of Tobacco cost £12, what is the Value of 1lb. *Answ.* £0 2 6

If £12 buy 96lb. of Tobacco what Quantity may be bought for 2s. 6d. *Answ.* 1lb.

If

If a Pair of Shoes cost 4s. 9d. what will 1 Dozen cost? *Answ.* £ 2 17 0

If 1 Dozen Pair of Shoes were bought for £ 2 17 0, what is that per Pair? *Answ.* £ 0 4 9

If 1 Pair of Shoes cost £ 0 4 9, how many Pair can be bought for £ 2 17 0 *Answ.* 1 Doz.

If 1 Yard of Cloth cost 15s. what will $32\frac{1}{2}$ Yards cost? *Answ.* £ 24 7 6

If 1 lb. of Sugar cost 11d. what will 1 cwt. cost? *Answ.* £ 5 2 8

If $32\frac{1}{2}$ Yards cost £ 24 7 6, what is the Value of 1 Yard? *Answ.* £ 0 15 0

If 12 Yards of Cloth cost 15s. what will 500 Ells Flemish cost at the same Rate? *Answ.* £ 23 8 9

If 500 Ells Flemish cost £ 23 8 9, what is the Value of 12 Yards? *Answ.* £ 0 15 0

If 4 Ounces of Gold are worth £ 20 16 6, what is the Value of 1 Grain? *Answ.* £ 0 0 $2\frac{1}{2}\frac{792}{1920}$

If 1 Grain of Gold is worth 2d. $\frac{1}{2}\frac{792}{1920}$, what is the Value of 4 Ounces? *Answ.* £ 20 16 6

If 17 Quarters cost 9s. what will 1296 Yards cost? *Answ.* £ 137 4 $5\frac{1}{2}\frac{10}{17}$

If £ 137 4 $5\frac{1}{2}\frac{10}{17}$ buy 1296 Yards, what is the Value of 17 Quarters? *Answ.* £ 0 9 0

What will 30 Hundred Weight, 3 Quarters, 17 Pounds, of Soap come to, at 7d. $\frac{1}{2}$ per lb. *Answ.* £ 108 9 $4\frac{1}{2}$

If 30 Hundred, 3 Quarters, 17 Pounds, cost £ 108 9s. 4d. $\frac{1}{2}$ what is that per Pound? *Answ.* £ 0 0 $7\frac{1}{2}$

If a Gentleman's Income is £ 1000 per Ann. and he spends 19s. 4d. a Day, how much does he lay up at the Year's End? *Answ.* £ 647 3 4

What will 5 Hogsheads of Sugar cost, each weighing 7 cwt. 3 q. 14 lb. Gross, Tare 10 per Cent. Tret 4 lb. per 104, at 7 d. $\frac{1}{2}$ per Pound? *Answ.* £ 119 18 9

In 5 Hogsheads of Tobacco, each 4 cwt. 3 q. 17 lb. what will it cost at 1 s. 3 d. per lb. Tare 10 per Cent. *Answ.* £ 156 5 0

If £ 2 3 4 was given for 3 lb. of Indigo, what must be given for 29 lb. 4 oz. at the same Rate? *Answ.* £ 21 2 6

If $9\frac{1}{2}$ Yards of Cambric cost £ 3 7 0, what will $33\frac{3}{4}$ cost? *Answ.* £ 11 18 $0\frac{1}{4}\frac{5}{19}$

If 25 Pieces of Holland, each 20 Ells, were bought for £ 265 17 6, what is that per Ell? *An.* £ 0 10 $7\frac{1}{2}$

If 1 Hundred Weight of Cheese cost £ 3 9 4, what must be given for $3\frac{1}{2}$ Pounds? *Answ.* £ 0 2 2

THE RULE OF THREE INVERSE.

RULE. Multiply the first and second Terms together, and divide the Product by the third; the Quotient will bear such Proportion to the second as the first does to the third.

EXAMPLES.

If 6 Men can do a Piece of Work in 15 Days, in how many Days can 17 Men do the same? *Answ.* $5\frac{5}{17}$

```
M. ———————— D. ———— M.
If 6         15       17
              6
            ----
        17)90(5
            85
            ----
             5
            ----
            17
```

If, when the Bushel of Wheat is sold for 8 s. the Penny-Loaf weighs 8 oz. how much ought it to weigh when the Bushel is worth but 6 s. *Answ.* $10\frac{2}{3}$ oz.

If I lend my friend £ 1000 Pounds for 6 Months, how long ought he to lend me £ 90 to requite my kindness? *Answ.* $66\frac{2}{3}$ Months.

How many Hats, of 10 s. Value, are equal to 240 Hats of 6 s. Value? *Answ.* 144 H.

If, when the Bushel of Wheat is sold for 6 Shillings, the Penny-Loaf weighs $10\frac{2}{3}$ oz. what will it weigh when the Bushel is sold for 8 Shillings? *Answ.* 8 oz.

If I lend my Friend £ 90 for $66\frac{2}{3}$ Months, how long ought he to lend me £ 1000 to requite my Kindness? *Answ.* 6 Months.

How

How many Hats of 6 s. Value are equal to 144 Hats of 10 s. Value? *Answ.* 240 H.

DOUBLE RULE OF THREE

Is composed of 5 Numbers given, to find out a 6th; which, if the Proportion is direct, must bear such Proportion to the 4th and 5th as the 3d bears to the 1st and 2d; but, if inverse, the 6th Number must bear such Proportion to the 4th and 5th as the 1st bears to the 2d and 3d. The 3 first Terms are a Supposition; the 2 last a Demand.

RULE. 1. Let the principal Cause of Loss or Gain, Interest or Decrease, Action or Passion, be put in the 1st Place. 2. Let Time, Distance of Place, and the like, be in the 2d Place, and the remaining one in the 3d. 3. Place the other two Terms under their like in the Supposition. 4. If the Blank falls under the 3d Term, multiply the 1st and 2d Terms for a Divisor, and the other three for a Dividend. 5. But, if the Blank falls under the 1st or 2d Term, multiply the 3d and 4th Terms for a Divisor, and the other three for the Dividend, and the Quotient will be the Answer.

PROOF. By 2 Single Rules of Three.

EXAMPLES.

If 3 Horses eat 9 Bushels of Oats in 20 Days, how many Bushels will be sufficient for 10 Horses 30 Days? *Answ.* 45 Bushels.

	H. Bu. H.		B.
As	3 9 10	=	30
	D.		
As	20 30 30	=	45

or $\dfrac{10 \times 30 \times 9 = 2700}{3 \times 20 = 60} = 45$ *Ans.*

If £ 200, in 12 Months, gain £ 12, how much will £ 79 gain in 9 Months? *Answ.* £ 3 7 6

If I pay 5 s. for the Carriage of 1 cwt. 10 Miles, what must I pay for the Carriage of 4 Tons 13 Miles? *Answ.* £ 5 4 0

If

If 20s. will pay 6 Men for 9 Days Work, how much will pay 13 Men 12 Days Work?

Answ. £ 2 17 $9\frac{1}{4}\frac{3}{9}=\frac{1}{3}$.

If the Carriage of 4 Tons 13 Miles cost £ 5 4 0, what will be the Expence for 5 cwt. 10 Miles?

Answ. 5 Shillings.

If £ 2 17 $9\frac{1}{4}\frac{1}{3}$ will pay 13 Men 12 Days Work, how much will pay 6 Men for 9 Days Work? — *Ans.* £ 1 0 0

If £ 79 gain £ 3 7 6 in 9 Months, how much will £ 200 gain in 12 Months? *Answ.* £ 12 0 0

If 45 Bushels of Oats are sufficient for 10 Horses 30 Days, what will be sufficient for 3 Horses 20 Days?

Answ. 9 Bushels.

PRACTICE

Is so called from the general Use made thereof by all Persons concerned in Business.

All Questions in this Rule are performed by taking aliquot or even Parts.

TABLE.

Of a Pound.		*Of a Shilling.*		*Of a Ton.*		*Of a Cwt.*	
10s. is —	$\frac{1}{2}$	6d. is —	$\frac{1}{2}$	10 cwt. is	$\frac{1}{2}$	2 qrs. or 56 lb. is	$\frac{1}{2}$
6. 8 — —	$\frac{1}{3}$	4 — — —	$\frac{1}{3}$	5 — — —	$\frac{1}{4}$	1 — or 28 — —	$\frac{1}{4}$
5 — — —	$\frac{1}{4}$	3 — — —	$\frac{1}{4}$	4 — — —	$\frac{1}{5}$	16 — —	$\frac{1}{7}$
4 — — —	$\frac{1}{5}$	2 — — —	$\frac{1}{6}$	$2\frac{1}{2}$ — —	$\frac{1}{8}$	14 — —	$\frac{1}{8}$
3 4 — —	$\frac{1}{6}$	$1\frac{1}{2}$ — —	$\frac{1}{8}$	2 — —	$\frac{1}{10}$	*Of a Quarter.*	
2 6 — —	$\frac{1}{8}$	1 — —	$\frac{1}{12}$			14 lb. is — —	$\frac{1}{2}$
2 — —	$\frac{1}{10}$					7 — — — —	$\frac{1}{4}$
1 8 —	$\frac{1}{12}$					4 — — — —	$\frac{1}{7}$
1 3 —	$\frac{1}{16}$					$3\frac{1}{2}$ — — —	$\frac{1}{8}$

RULE 1. When the Price is less than a Penny, divide by the aliquot Parts that are in a Penny, then by 12 and 20.

EXAMPLES.

¼ is ¼)3456 lb. at ¼	7401 lb. at ½	3079 lb. at ¾
12)864	£ 15 8 4½	£ 9 12 5¼
2|0)7|2	9874 lb. at ½	4567 lb. at ¾
£ 3 12 0	£ 20 11 5	£ 19 5 5¼

RULE 2. When the Price is less than a Shilling, and more than 3 Farthings, take the aliquot Part or Parts that are in a Shilling, add them together, and divide by 20.

1 is $\frac{1}{12}$)7509 at 1 d.	$\frac{1}{12}$)3095 at 1¼ d.	7095 at 1½ d.
2|0)62|5 9	¼ ¼)257 11	*Answ.* 44 6 10½
£ 31 5 9	64 5¾	3706 at 1¾ d.
	2|0)32|2 4¾	*Answ.* 27 0 5½
	£ 16 2 4¾	

3049 at 2 d.	7096 at 2¼ d.	9000 at 2½ d.
£ 25 8 2	£ 66 10 6	£ 93 15 0
3709 at 2¾ d.	4075 at 3 d.	3074 at 3¼ d.
£ 42 9 11¾	£ 50 18 9	£ 41 12 6½
3049 at 3½ d.	9876 at 3¾ d.	7406 at 4 d.
£ 44 9 3½	£ 154 6 3	£ 123 8 8
9075 at 4¼ d.	6909 at 4½ d.	9876 at 4¾ d.
£ 160 14 0¾	£ 129 10 10½	£ 195 9 3
7096 at 5 d.	7096 at 5¼ d.	9065 at 5½ d.
£ 147 16 8	£ 155 4 6	£ 207 14 9½
3999 at 5¾ d.	6000 at 6 d.	7000 at 6¼ d.
£ 95 16 2¼	£ 150 0 0	£ 182 5 10

5670

5670 at $6\frac{1}{2}$ d. £ 153 11 3	6789 at $6\frac{3}{4}$ d. £ 190 18 $9\frac{3}{4}$	4709 at 7 d. £ 137 6 11
7546 at $7\frac{1}{4}$ d. £ 227 15 5	9875 at $7\frac{1}{2}$ d. £ 308 11 $10\frac{1}{2}$	4075 at $7\frac{3}{4}$ d. £ 130 6 $7\frac{1}{2}$
7049 at 8 d. £ 234 19 4	9406 at $8\frac{1}{4}$ d. £ 323 6 7	5706 at $8\frac{1}{2}$ d. £ 202 1 9
6789 at 9 d. £ 254 11 9	7096 at $9\frac{1}{4}$ d. £ 273 9 10	8750 at $9\frac{1}{2}$ d. £ 346 7 1
7507 at $9\frac{3}{4}$ d. £ 304 19 $5\frac{1}{4}$	9876 at 10 d. £ 411 10 0	7040 at $10\frac{1}{4}$ d. £ 300 13 4
4567 at $10\frac{1}{2}$ d. £ 200 6 $1\frac{1}{2}$	7409 at $10\frac{3}{4}$ d. £ 331 17 $2\frac{3}{4}$	6000 at 11 d. £ 275 0 0
4578 at $11\frac{1}{4}$ d. £ 214 11 $10\frac{1}{2}$	7049 at $11\frac{1}{2}$ d. £ 337 15 $3\frac{1}{2}$	3740 at $11\frac{3}{4}$ d. £ 183 1 10

RULE 3. When the Price is more than 1 Shilling, and leſs than 2, take the Part or Parts, with ſo much of the given Price as is more than a Shilling; which add to the given Quantity, and divide by 20, it will give the Anſwer.

$\frac{1}{2}\frac{1}{4}\frac{1}{2}$)2150 at $12\frac{3}{4}$d. 44 $9\frac{1}{2}$ 2|0)219|4 $9\frac{1}{2}$ £ 109 14 $9\frac{1}{2}$	$\frac{1}{2}\frac{1}{4}$)2701 at $12\frac{1}{2}$d. 112 $6\frac{1}{2}$ 2|0)281|3 $6\frac{1}{2}$ £ 140 13 $6\frac{1}{2}$	2075 at $12\frac{3}{4}$d. £ 110 4 $8\frac{1}{4}$ 1070 at 13d. £ 57 19 2
1046 at 1s. $1\frac{1}{4}$d. £ 57 14 $11\frac{1}{2}$	1709 at 1s. $1\frac{1}{2}$d. £ 96 2 $7\frac{1}{2}$	1704 at 1s. $1\frac{3}{4}$d. £ 102 15 $7\frac{1}{2}$
1760 at 1s. 2d. £ 102 13 4	1095 at 1s. $2\frac{1}{4}$d. £ 65 0 $3\frac{3}{4}$	1046 at 1s. $2\frac{1}{2}$d. £ 63 3 11

4570 at 1s. 2¾d.	3709 at 1s. 3d.	4706 at 1s. 3¼d.
£ 280 17 3½	£ 231 16 3	£ 299 0 6½
3470 at 1s. 3½d.	2709 at 1s. 3¾d.	3705 at 1s. 4d.
£ 224 2 1	£ 177 15 6¾	£ 247 0 0
2706 at 1s. 4¼d.	3706 at 1s. 4½d.	7050 at 1s. 4¾d.
£ 183 4 4½	£ 254 15 9	£ 492 0 7½
3409 at 1s. 5d.	7042 at 1s. 5¼d.	3705 at 1s. 5½d.
£ 241 9 5	£ 506 2 10½	£ 270 3 1½
3075 at 1s. 5¾d.	2075 at 1s. 6d.	4705 at 1s. 6¼d.
£ 227 8 5¼	£ 155 12 6	£ 357 15 6¼
1234 at 1s. 6½d.	1207 at 1s. 6¾d.	1470 at 1s. 7d.
£ 95 2 5	£ 94 5 11¼	£ 116 7 6
1470 at 1s. 7¼d.	1234 at 1s. 7½d.	1270 at 1s. 7¾d.
£ 117 18 1½	£ 100 5 3	£ 104 10 2½
2345 at 1s. 8d.	3407 at 1s. 8¼d.	2709 at 1s. 8½d.
£ 195 8 4	£ 287 9 3¾	£ 231 6 7½
4567 at 1s. 8¾d.	2345 at 1s. 9d.	1234 at 1s. 9¼d.
£ 394 17 1¼	£ 205 3 9	£ 109 5 2½
3450 at 1s. 9½d.	2345 at 1s. 9¾d.	2075 at 1s. 10d.
£ 309 12 0	£ 212 10 3¾	£ 190 4 2
1234 at 1s. 10¼d.	2345 at 1s. 10½d.	1234 at 1s. 10¾d.
£ 114 8 0½	£ 219 16 10½	£ 116 19 5½
4075 at 1s. 11d.	3027 at 1s. 11¼d.	2107 at 1s. 11½d.
£ 390 10 5	£ 293 4 9¾	£ 206 6 2½
5072 at 1s. 11¾d.	3704 at 1s. 11¾d.	705 at 1s. 11¾d.
£ 501 18 4	£ 366 10 10	£ 69 15 3¾

RULE

RULE 4. When the Price consists of any even Number of Shillings under 20, multiply the given Quantity by Half the Price, doubling the first Figure of the Product for Shillings, and the Rest of the Product will be Pounds.

2705 at 2s. £ 270 5 0	2076 at 4s. £ 415 4 0	3074 at 6 s. £ 922 4 0
1047 at 8s. £ 418 16 0	3574 at 10 s. £ 1787 0 0	1075 at 12 s. £ 645 0 0
3047 at 14s. £ 2132 18 0	7096 at 16 s. £ 5676 16 0	4017 at 18 s. £ 3615 6 0

RULE 5. When the Price consists of odd Shillings multiply the given Quantity by the Price, and divide by 20.

2074 at 1 s. £ 135 4 0	7049 at 3 s. £ 1057 7 0	4065 at 5. £ 1016 5 0
3072 at 7 s. 7 2|0)2150|4 £ 1075 4 0	7056 at 9 s. £ 3175 4 0	3076 at 11 s. £ 1691 16 0
	4065 at 13 s. £ 2642 5 0	7025 at 15 s. £ 5268 15 0
2074 at 17 s. £ 1762 18 0	1709 at 19 s. £ 1623 11 0	2064 at 19 s. £ 1960 16 0

RULE 6. When the Price is Shillings and Pence, and they the aliquot Part of a Pound, divide by the aliquot Part, and it will give the Answer at once; if not the aliquot Part, multiply the Quantity by the Shillings, and take Parts for the Rest, add them together, and divide by 20.

⅙)2456 at 3s. 4d. £409 6 8	3456 at 1s. 3d. £216 0 0	2074 at 1s. 4d. £138 5 4
2075 at 1s. 8d. £172 18 4	2345 at 2s. 6d. £293 2 6	1234 at 6s. 8d. £411 6 8
¼)2047 at 3s. 3d. 3 6141 511 9 2]0)665|2 9 £332 12 9	1234 at 4s. 7½d. £285 7 3 2074 at 5s. 9¾d. £602 15 1¼	2045 at 5s. 3¼d. £536 16 3 3047 at 15s. 8½d. £2393 3 3½
704 at 19s. 11¾d. £703 5 4	8069 at 14s. 10½d. £6001 6 4½	1407 at 15s. 7¼d. £97 15 0¼
3045 at 12s. 5¾d. £1899 19 0¾	2075 at 17s. 7¼d. £1826 8 7¾	1046 at 13s. 3½d. £695 3 1
1046 at 9s. 9½d. £512 2 1	1029 at 7s. 7¼d. £391 4 8¼	2357 at 14s. 4¼d. £1691 12 9¼

RULE 7. First. When the Price is Pounds and Shillings multiply the Quantity by the Pounds, and proceed with the Shillings, if they are even, as in the 4th Rule; if odd, take the aliquot Parts, add them together, and the Sum will be the Answer. —— 2. When Pounds, Shillings, and Pence, and the Shillings and Pence the aliquot Part of a Pound, multiply the Quantity by the Pounds, and take Parts for the Rest. —— 3. When the Price is Pounds, Shillings, Pence, and Farthings, and the Shillings and Pence not the aliquot Parts of a Pound, reduce the Pounds and Shillings into Shillings, multiply the Quantity by the Shillings, take Parts for the Rest, add them together, and divide by 20.

Note. When the given Quantity is no more than two Figures proceed as in compound Multiplication.

⅓)3456 at 3s. 4d. 3 10368 691 4 £11059 4 0	204 at £5 4 6 £1065 18 0 304 at £7 12 9¼ £2322 2 4	304 at £15 14 8½ £4783 11 4 206 at £5 2 0 £1050 12 0
3075 at £1 7 6¾ £4160 17 2¼	2075 at £3 18 11¾ £8550 11 9	2049 at £6 14 9¼ £13807 5 5½
2049 at £1 5 8 £2629 11 0	206 at £17 17 7 £3683 2 2	25 at £19 19 11½ £499 18 11½
37 at £12 12 7¼ £454 13 9	44 at £15 18 6½ £700 15 10	2074 at £3 10 0 £7259 0 0

RULE 8. When the Price and Quantity given are of several Denominations multiply the Price by the Integers, and take Part with the Parts of the Integers for the Rest.

At £2 16 4 per Cwt. what is the Value of 24 Hundred Weight and 3 Quarters of Sugar?

```
2    ½     2 16  4
                 6
          ---------
          16 18  0
                 4
          ---------
2    ½    67 12  0
           1  8  2
           0 14  1
          ---------
        £ 69 14  3  Answ.
```

At £7 14 11¼ per Cwt. what will 16 cwt. 3 qrs. 19 lb. come to? *Answ.* £131 2 2

At £3 14 2 per Cwt. what must be given for 70 cwt. 3 qrs.? *Answ.* £262 7 3½

Bought

Bought 35 cwt. 3 qrs. 12 lb. of Prunes a £ 4 7 9 per Hundred Weight, what did I give for the Whole?

Answ. £ 157 6 $7\frac{1}{14}$

Sold 40 cwt. 3 qrs. 19 lb. of Stone Blue at £ 9 17 $8\frac{3}{4}$, what did it come to?

Answ. £ 404 11 0

What is the Value of 99 cwt. 3 qrs. 17 lb. of Tobacco, at £ 3 17 $11\frac{1}{2}$ per Cwt.

Answ. £ 389 8 $1\frac{3}{4}$ $\frac{77}{98}$

Bought 5 cwt. 2 qrs. 9 lb. of Brimstone, at £ 2 5 $8\frac{1}{4}$, what did it come to?

Answ. £ 12 14 $11\frac{567}{3136}$

INTEREST.

Simple Interest is the Profit allowed in lending any Sum of Money, called the Principal, for a determined Space of Time. The Rate *per Cent.* is a certain Sum agreed on between the Borrower and the Lender, to be paid for every £ 100 for the Use of the Principal 12 Months. The Amount is the Principal and Interest added together.

Interest is also applicable to Commission, Brokerage, Purchasing of Stocks, &c.

1. To find the Interest of any Sum of Money for a Year.

RULE. Multiply the Principal by the Rate *per Cent.* and that Product divide by 100.

For several Years.

2. Multiply the Interest of one Year by the Number of Years given, and the Product will be the Answer.

When the Time is $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a Year, besides a Number of Years given, and $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ more than the given Pounds in the Rate, multiply the Principal by the Rate, and for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, take the Part or Parts from the Principal, which add to the Product and divide by 100, and it will give the Answer for one Year; which multiply by the Years given, and for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, take Part or Parts from the Principal, add them together, and it will give the Answer.

Examples.

What is the Interest of £ 560 for a Year, at 4 *per Cent. per Annum?*

```
       560
         4
    -------
100)22|40      Answ. £ 22 8 0
       20
    -------
      8|00
```

What is the Interest of £ 296, at 4 *per Cent.* for 1 Year? *Answ.* £ 11 16 $9\frac{1}{2}$ $\frac{2}{5}$

What is the Interest of £ 684, for 1 Year, at 5 *per Cent. per Annum?* *Answ.* £ 34 4 0

What is the Interest of £ 396 14 7, for 2 Years, at 4 *per Cent. per Annum?* *Answ.* £ 31 14 9

What is the Interest of £ 6948 17 $7\frac{1}{4}$, for 7 Years, at 3 *per Cent. per Annum?* *Answ.* £ 1459 5 $3\frac{1}{2}$

What is the Interest of £ 965 10, for 4 Years, at $4\frac{1}{2}$ *per Cent.?* *Answ.* £ 173 15 9

What is the Interest of £ 695 17 $6\frac{1}{2}$, for 2 Years, at $2\frac{1}{2}$ *per Cent.?* *Answ.* £ 34 15 $10\frac{1}{2}$

What is the Interest of £ 320 10 4, for 7 Years, at $3\frac{1}{4}$ *per Cent.?* *Answ.* £ 84 2 $8\frac{1}{2}$ $\frac{1}{5}$

What is the Interest of £ 960 10 $8\frac{1}{2}$, for $3\frac{1}{4}$ Years, at 3 *per Cent.?* *Answ.* £ 100 17 1

What is the Interest of £ 670 12 9, for $2\frac{1}{2}$ Years, at 4 *per Cent.?* *Answ.* £ 67 1 3

What is the Interest of £ 750 18 $7\frac{1}{2}$, for $5\frac{1}{4}$ Years, at 5 *per Cent.?* *Answ.* £ 215 17 10

What is the Interest of £ 690 18 $6\frac{3}{4}$, for $5\frac{1}{4}$ Years, at $5\frac{1}{4}$ *per Cent.?* *Answ.* £ 190 8 $8\frac{3}{4}$

What is the Interest of £ 697 15 8, for $2\frac{1}{2}$ Years, at $2\frac{1}{2}$ *per Cent.?* *Answ.* £ 43 12 $2\frac{3}{4}$

What is the Interest of £ 10004 17, for $3\frac{3}{4}$ Years, at $3\frac{3}{4}$ *per Cent.?* *Answ.* £ 1406 8 $7\frac{1}{2}$ $\frac{75}{100}$

What is the Amount of £ 596 18, for $3\frac{3}{4}$ Years, at $3\frac{1}{4}$ *per Cent.?* *Answ.* £ 680 5 $6\frac{3}{4}$ $\frac{9}{16}$

What is the Amount of £ 604 15 8, for $2\frac{1}{2}$ Years, at 2 *per Cent.?* *Answ.* £ 635 9 $5\frac{1}{4}$ $\frac{1}{5}$

What

What is the Amount of £ 507 18 8½, for 4½ Years, at 4 *Cent.* ?   *Answ.* £ 594 5 8¼ $\frac{89}{100}$

When the Interest is for any Number of Weeks.

RULE. As 52 Weeks are to the Interest of the given Sum for a Year, so are the Weeks given to the Interest required.

What is the Interest of £ 396 10 8, for 5 Weeks, at 4 *per Cent.* ?

```
         W.                  W.          396  10   8
As 52 — 15  17  2½ — 5                          4
        20                              ---------
        ---                             15,86  2  8
        317                                   20
         12                                  -----
        ----                                 17,22
        3806                                   12
           4                                 -----
        -----                                 2,72
        15226                                    4
            5                                -----
        -----  4)                             ½,88
   52)76130( 1464                            -----
       52
       ---       12)366          4×13=52  13)15  17   2½
       241       ------                    -----------
       208       2|0)30  6                   1   4   4¾
       ---       -------               1)-¼ (0  .6  .1
       333    £ 1  10  6 Ans.              -----------
       312                                £ 1  10   5¼
       ---
       210
       208
       ---
         2
```

What is the Interest of £ 640 17 8, for 19 Weeks, at 4¼ *per Cent.* ?   *Answ.* £ 9 19 0½ $\frac{476}{5200}$

What is the Interest of £ 297 12, for 35 Weeks, at 2½ *per Cent.* ?   *Answ.* £ 5 0 1¼ $\frac{10}{26}$

What is the Interest of £ 374 9, for 13 Weeks, at 3¾ *per Cent.* ?   *Answ.* £ 3 10 2½ $\frac{65}{200}$

 What

What is the Interest of £ 570 10, for 14 Weeks, at 5 *per Cent.*? *Answ.* £ 7 13 7 $\frac{2}{13}$

What is the Interest of £ 470 10 7½, for 9 Weeks, at 3 *per Cent.*? *Answ.* £ 2 8 10 $\frac{30027}{37816}$

When the Interest is for any Number of Days.

Rule. As 365 Days are to the Interest of the given Sum for a Year, so are the Days given to the Interest required.

What is the Interest of £ 460, for 145 Days, at 4 *per Cent.*?

```
                               4
                             -----
                             18|40
                               2|0
                             -----
                              80|0

 D.        £    s.    D.                    £
As 365 — 18    8 — 145.                    460
          20                               240
        ----                            ------
         368                             18400
         145                             920
        ----                            ------
        1840                            110400 Pence.
        1472                                 4
        368                             ------
        -------2|0)                      441600
    365)53360(14|6                          145
        365      ------                 ------
        ------£ 7 6 2¼                  2208000
        1686                            1766400
        1460                            441600
        ----                            --------
        2260                       365)64032000
        2190                            365
        ----                            ----      12)1754
          70                            2753      -------
          12                            2555        146
        ----                            ----
        840(2                           1982      £ 7 6 2¼
        730                             1825
        ----                            ----
```

The Operation continued.

110	1570
4	1460
440(¼	110
365	4
75	440 ¼
365	365
	75
	365

What is the Interest of £ 384 17 6 for 2 Years and 64 Days, at 3 *per Cent. per Ann.* *Answ.* £ 26 5 $2\frac{224}{3650}$

What is the Interest of £ 496 10 0 for 3 Years and 49 Days, at 3½ *per Cent. per Ann.* *Answ.* £ 54 9 3½ $\frac{689}{3650}$

What is the Interest of £ 296 12 0 for 1 Year and 146 Days, at 4¼ *per Cent. per Ann.* *Answ.* £ 17 12 11¼ $\frac{1227}{9125}$

What is the Interest of £ 1047 10 8¾ for 5 Years and 175 Days, at 2¼ *per Cent. per Ann.* *Answ.* £ 158 1 6¾

When the Amount, Time, and Rate, *per Cent.* are given, to find the Principal.

RULE. As the Amount of £ 100, at the Time and Rate given, is to 100, so is the Amount given to the Principal required.

What is the present Worth of a Debt of £ 530 10 0, payable 3 Years hence, allowing Discount at 4 *per Cent. per Annum?*

```
                                    £    s.
As 112 ———— 100 — 530  10
    20                               20
   ————                          ————————
   2240        224|0)10610|0(£ 473  13  2½ 2/7
   ————               896
                     ————
                      1650
                      1568
                     ————
                       820
                       672
                     ————
                       148
                        20
                     ————
                      2960(13
                      224
                     ————
                       720
                       672
                     ————
                        48
                        12
                     ————
                       576(2
                       448
                     ————
                       128
                         4
                     ————
                       512(2
                       448
                     ————
                        64 equal to 2/7
                       224
                     ————
```

What is the present Worth of £ 420, payable 3 Years hence, at 4 *per Cent. per Annum?* *Answ.* £ 375 0 0

What is the present Worth of a Debt of £ 960, payable 4 Years hence, at 5 *per Cent.* *Answ.* £ 800 0 0

What

What Principal, put to Interest for 7 Years, will amount to £ 765 10 6, at 4 *per Cent. per Annum*?

Answ. 598 1 $3\frac{3}{4}$ $\frac{3}{4}$

What Principal, put to Interest for $3\frac{1}{2}$ Years, will amount to £ 496 10 0, at 3 *per Cent. per Annum*?

Answ. £ 449 6 5 $\frac{23}{221}$

What is the present Worth of a Debt of £ 697 10 6, payable $3\frac{1}{2}$ Years hence, allowing Discount at $4\frac{3}{4}$ *per Cent. per Annum*?

Answ. £ 612 17 $5\frac{1}{4}$ $\frac{101}{607}$

What Principal, being put to Interest for 2 Years, will amount to £ 330, at $3\frac{3}{4}$ *per Cent. per Annum*?

Answ. £ 306 19 $6\frac{1}{4}$ $\frac{28}{43}$

What Principal, being put to Interest for $2\frac{1}{2}$ Years, will amount to £ 690 17 6, at $4\frac{1}{2}$ *per Cent. per Ann.*?

Answ. £ 621 0 $2\frac{1}{2}$ $\frac{70}{89}$

When the Principal, Rate, *per Cent.* and Amount, are given, to find the Time.

Rule. As the Interest of the Principal for 1 Year is to 1 Year, so is the whole Interest to the Time.

In what Time will £ 473 13 $2\frac{1}{2}$ $\frac{2}{7}$ amount to £ 530 10*s.* at 4 *per Cent. per Annum*?

£	s.	d.
530	10	
473	13	$2\frac{1}{2}$ $\frac{2}{7}$
£ 56	16	$9\frac{1}{4}$ $\frac{5}{7}$

£	s.	d.
473	13	$2\frac{1}{2}$ $\frac{2}{7}$
	4	
18,94	12	$10\frac{1}{4}$ $\frac{1}{7}$
	20	
18,92		
	12	
11,14		
	4	
,57		
	7	
4,00		
	7	

In what Time will £ 375 amount to £ 420, at 4 *per Cent. per Annum?* *Answ.* 3 Years.

In what Time will £ 800 amount to £ 960, at 5 *per Cent.?* *Answ.* 4 Years.

In what Time will £ 598 1 $3\frac{1}{2}\frac{1}{2}$ amount to £ 765 10 6, at 4 *per Cent. per Annum?* *Ans.* 7 Years.

In what Time will £ 449 6 $5\frac{23}{221}$ amount to £ 496 10, at 3 *per Cent. per Annum?* *Answ.* $3\frac{2}{3}$ Years.

In what Time will £ 612 17 $5\frac{1}{4}\frac{101}{607}$ amount to £ 697 10 6, at $4\frac{1}{2}$ *per Cent. per Annum?* *Ans.* $3\frac{1}{3}$ Years.

In what Time will 306 19 $6\frac{1}{4}\frac{29}{43}$ amount to £ 330, at $3\frac{3}{4}$ *per Cent. per Annum?* *Answ.* 2 Years.

In what Time will £ 621 0 $2\frac{1}{2}\frac{70}{89}$ amount to £ 690 17 6, at $4\frac{1}{2}$ *per Cent. per Annum?* *Ans.* $2\frac{1}{2}$ Years.

When the Principal, Amount, and Time, are given, to find the Rate *per Cent.*

Rule. As the Principal is to the Interest for the whole Time, so is £ 100 to the Interest for the same Time. Divide that Interest by the Time, and the Quotient will be the Rate *per Cent.*

At

At what Rate *per Cent.* will £ 598 1 $3\frac{3}{4}\ \frac{3}{4}$ amount to £ 765 10 6, in 7 Years? *Answ.* 4 *per Cent.*

As £ 598 1 $3\frac{3}{4}\ \frac{3}{4}$ — 167 9 $2\frac{1}{16}$ — £ 100

20	20	20
11961	3349	2000
12	12	12
143535	40190	24000
4	16	4
574143	643041	96000
4	384000	4
2296575	2572164000	384000
	5144328	
	1929123.	

2296575)246927744000(16)107520

2296575

765 10 6	17270244	12)6720
598 1 $3\frac{3}{4}\ \frac{3}{4}$	16076025	2|0)56|0
167 9 $2\frac{1}{16}$	11942190	7)28
	11482875	*Ans.* 4 *per Cent.*
	..459315o	
	4593150	
	0	

At what Rate *per Cent.* will £ 375 amount to £ 420, in 3 Years? *Answ.* 4 *per Cent.*

At what Rate *per Cent.* will £ 800 amount to £ 960, in 4 Years? *Answ.* 5 *per Cent.*

At what Rate *per Cent.* will £ 449 6 $5\frac{23}{221}$ amount to £ 496 10 0, in $3\frac{1}{2}$ Years? *Answ.* 3 *per Cent.*

At what Rate *per Cent.* will £ 612 17 $5\frac{1}{4}\ \frac{101}{607}$ amount to £ 697 10 6, in $3\frac{1}{4}$ Years? *Answ.* $4\frac{1}{4}$ *per Cent.*

At what Rate *per Cent.* will £ 306 19 $6\frac{1}{4}\ \frac{29}{43}$ amount to £ 330, in 2 Years? *Answ.* $3\frac{3}{4}$ *per Cent.*

At

At what Rate *per Cent.* will £ 621 0 $2\frac{1}{4}$ $\frac{70}{89}$ amount to £ 690 17 6, in $2\frac{1}{2}$ Years? *Answ.* $4\frac{1}{2}$ *per Cent. per Ann.*

COMPOUND INTEREST,

Is when the Interest on Money becomes due, and is not paid. The same Interest is allowed on that Interest unpaid as was allowed on the Principal at first.

RULE 1. Find the first Year's Interest, which add to the Principal; then find the Interest of that Sum, which add as before, and so on for any Number of Years. Subtract the given Sum from the last Amount, or add the Interest of the several Years together, and it will give the Compound-Interest. — To find the Amount, add the Principal and Interest together.

EXAMPLES.

What is the Compound Interest of £ 400, forborne 3 Years, at 4 *per Cent.* ?

16 12 $9\frac{1}{2}$	400	17 6 $1\frac{1}{2}$
416	4	432 12 $9\frac{1}{2}$
432 12 $9\frac{1}{2}$ 2d Year.	16|00	449 18 $10\frac{3}{4}$
4	400	400 0 0
17|30 11 2	£ 416 first Y.	£ 49 18 $10\frac{3}{4}$ *A.*
20	4	
6|11	16|64	
12	20	
1|34	12|80	
4	12	
1|36	9|60	
	4	
	2|40	

What

What is the compound Interest of £ 600, for 2 Years, at 5 *per Cent.*? *Answ.* £ 61 10 0

What is the compound Interest of £ 700, for 3 Years, at 4 *per Cent.*? *Answ.* £ 87 8 1

What is the compound Interest of £ 500, for 4 Years, at 3 *per Cent.*? *Answ.* £ 62 15 1

What is the compound Interest of £ 400, for 5 Years, at 2 *per Cent.*? *Answ.* £ 41 12 7

What is the Amount of £ 300, in $3\frac{1}{2}$ Years, at $2\frac{1}{2}$ *per Cent.* compound Interest? *Answ.* £ 327 2 1

What is the compound Interest of £ 200 10 0, for 2 Years and 9 Months, at $3\frac{1}{4}$ *per Cent.*? *Answ.* £ 18 9 $0\frac{1}{2}$

What is the Amount of £ 120 10 0, for $3\frac{1}{4}$ Years, at $3\frac{3}{4}$ *per Cent.* compound Interest? *Answ.* £ 139 5 1

What is the compound Interest of £ 300, for $2\frac{1}{4}$ Years, at $2\frac{1}{4}$ *per Cent.*? *Answ.* £ 15 8 $3\frac{1}{2}$

What is the Amount of £ 600, for $3\frac{1}{2}$ Years, at $4\frac{1}{4}$ *per Cent.* compound Interest? *Answ.* £ 694 4 10

COMMISSION

Is an Allowance from Merchants to their Factors in the Buying or Selling of Goods, and is at a certain Rate *per Cent.* according to the Custom of the Country where the Factor resides.

RULE. Multiply the Principal by the Rate *per Cent.* and for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, &c. take the Part or Parts from the Principal, which add to the Product, and divide by 100.

EXAMPLES.

What is the Commission of £ 396 18 $7\frac{1}{2}$ at $3\frac{3}{4}$ *per Cent.*?

 £ 396

```
            £ 396  18   7½
                        3
            ---------------
½ is ½    11|90  15  10½
¼ — ½       198   9   3¾
             99   4   7¾  ½
            ----------------
          14|88   9  10— ½
              20
          ------
          17|69
             12          Answ. £ 14 17 8¼
          ------
           8|38
              4
          ------
           ¼|52
          ------
```

What is the Commission for laying out £ 796 14 8 at 3¼ *per Cent.*? *Answ.* £ 25 17 10½

If I have bought Goods to the Amount of £ 4759 17 6, what is my Commission at 4½ *per Cent.*?

Answ. £ 214 3 10½

If I allow my Factor 2¾ *per Cent.* for Commission, what may he demand on laying out £ 496 10 0?

Answ. £ 13 13 0¼

What is the Commission on £ 496 12 0 at 4½ *per Cent.*? *Answ.* £ 22 6 11¼ $\frac{3}{25}$

PURCHASING OF STOCKS.

RULE. Multiply the Sum to be purchased by the Excess above 100, and divide that Product by 100; the Produce of which, added to the given Sum, is the Purchase required.

If under Par, that is, under £ 100, multiply by the Rate *per Cent.* and that Product, divided by 100, will give the Purchase thereof.

EXAMPLES.

EXAMPLES.

What is the Purchase of £ 596 14 of 3 *per Cent.* Consolidated Annuities, at $63\frac{1}{2}$ *per Cent.*?

7×9=63

```
   596  14
         9
  ---------
  5370   6
         7
  ---------
 37592   2 = 63
   298   7 = ½
  ---------
 378,90  9
     20
  -------
  18,09
     12
  -------
   1,08
      4
  -------
    ,32
```

£ 378 18 $1\frac{8}{25}$ *Answ.*

What is the Purchase of £ 755 15 India Stock, at $141\frac{1}{2}$ *per Cent.*?

5×8+1=41

```
    755  15
          8
   ---------
   6046   0
          5
   ---------
  30230   0=40
    755  15=1
    377  17  6=½
   -------------
 313,63  12  6=41½
     20
   -------
  12,72
     12
   -------
   8,70
      4
   -------
   2,80

   313  12  8½ 4/5
   755  15
   -------------
£ 1069   7  8½ 4/5 Answ.
```

What is the Purchase of £ 2065 17 South-Sea Stock, at $107\frac{3}{8}$ *per Cent.*? *Answ.* £ 2218 4 $1\frac{1}{2}$

At $64\frac{1}{2}$ *per Cent.* what is the Purchase of £ 1770 19 6 Long-Annuities? *Answ.* £ 1142 5 $6\frac{3}{4}$

What is the Purchase of £ 496 10 Old South-Sea Annuities, at $61\frac{1}{2}$ *per Cent.*? *Answ.* £ 305 6 $11\frac{1}{4}$

What is the Purchase of £ 4965 18 India-Stock, at $142\frac{1}{4}$ *per Cent.*? *Answ.* £ 7064 0 $2\frac{1}{10}$

 At

At $109\frac{5}{8}$ *per Cent.* what is the Purchase of £ 3000 Bank-Stock? *Answ.* £ 3288 15 0

REBATE or DISCOUNT

Is an Allowance of so much *per Cent.* for paying Money before it is due.

Rule. As £ 100, with the Interest for the Time, is to that Interest, so is the Sum given to the Rebate required.

Subtract the Rebate from the given Sum, and the Remainder will be the present Worth.

Note. According to the foregoing Rule the Discount is the Interest of the Money paid down, but the Interest of the whole Sum is commonly taken for the Discount.

Examples.

What is the Discount of £ 880, for 2 Years, at 5 *per Cent.*? *Answ.* £ 80 0 0

```
    £     £     £                      £      £      £
As 110 - 100 - 880                As 110 - 10 - 880
               100                                10
              ----- 880                         ----
       110)88000( 800                   110)8800(80An.
           880    ---                       8800
           ---    80 Answ.                  ----
                  ---                          0
```

What is the Discount of £ 480, for 1 Year, at 5 *per Cent.*? *Answ.* £ 22 17 $1\frac{1}{2}\frac{90}{105}$

What is the Discount of £ 300, for 9 Months, at 4 *per Cent.*? *Answ.* £ 8 14 $9\frac{9}{103}$

What is the present Payment of £ 400 10 0, payable 3 Months hence, at $3\frac{1}{2}$ *per Cent.*? *Answ.* £ 397 0 6

What

What is the present Worth of £200 4 0, payable 9 Months hence, at $3\frac{3}{4}$ *per Cent.*? *Answ.* £194 14 $5\frac{1}{2}$

Bought Goods to the Amount of £330, to be paid 8 Months hence, what present Money will discharge the Debt, Discount at $3\frac{1}{2}$ *per Cent.*? *Answ.* £322 9 6

How much ready Money am I to receive for a Note of Hand of £84 10 0, due 11 Months hence, Discount at $4\frac{1}{2}$ *per Cent.*? *Answ.* £81 3 $0\frac{1}{2}$

What is the present Worth of £450, payable at three 4 Months; one-third at 4 Months, one-third at 8 Months, and one-third at 12 Months, at 4 *per Cent.* Discount?

Answ. £436 19 $1\frac{3450044}{17479924}$

What is the Discount of £700, at 4 *per Cent.*?

Answ. £26 18 $5\frac{2}{13}$

ALPHABETICAL LIST OF COPIES, IN ENGLISH AND FRENCH.

A.

Art is gained by great Labour and Industry.
Aim at Improvement.

Aimez sans Intérêt. Pardonnez sans Foiblesse.

B.

Beauty without Virtue is but a painted Sepulchre.
Bounty creates Esteem.

Beauté sans Vertu n'est qu'un Sépulchre blanchi.

C.

Contentment is preferable to Riches and Honour.
Command your Passions.

Contentement vaut mieux que des Richesses et des Honneurs.

D.

Danger commonly follows inconsiderate Actions.
Degrade no Man's Merit.

Donnez Attention à tout ce qu'on vous dit.

E.

Evil Communication corrupts good Manners.
Emulation seldom fails.

Estimez un chacun dans sa Profession.

F.

Fraud in Childhood will become Knavery in Manhood.
Forgive your Enemies.

Fréquentez toujours la Compagnie des Bons.

G.

Good Behaviour is a very becoming Ornament.
Govern with Discretion.

Gouvernez-vous, si vous voulez vous venger d'un Ennemi.

H.

Hasty Resolutions are seldom fortunate.
Honour your Parents.

Heureux est l'Homme qui se trouve content.

I.

It is good to have a Friend, but bad to need him.
Innocence is a Beauty.

Il faut battre le Fer pendant qu'il est chaud.

J.

Jealousy is a green-eyed Monster.
Judge not by Appearance.

Jouez pour le Plaisir, et jouez noblement.

K.

Keep a close Mouth if you would have a wise Head.
Keep sacred your Promise

L.

L.

Learn to live as you would wiſh to die.
Learning is commendable.

Le Bien mal acquis ne profite jamais.

M.

Modeſt and prudent Behaviour is a Sign of Wiſdom.
Manners make the Man.

Modérez les Tranſports d'une Bile naiſſante.

N.

Neceſſity is the Mother of Invention.
Nothing is dearer than Time.

Ne divulguez jamais ce qu'on vous confie.

O.

Overcome every Propenſity that leads you to Vice.
Opinion guides Mankind.

Où la Diſcorde regne, apportez y la Paix.

P.

Purſue uſeful and profitable Studies.
Praiſe is greatly animating.

Parlez peu, penſez bien, et ne trompez Perſonne.

Q.

Quietneſs is too often ſacrificed to gain Wealth.
Quarrels are dangerous.

Quiconque mépriſe la Science ſe rend lui-même mépriſable.

R.

Reaſon improved makes Men like Angels.
Reſpect your Superiors.

Refléchiſſez avant que de Rien entreprendre.

S.

S.

Self-love is the greatest Flatterer in the World.
Shame attends on Folly.

Soyez officieux, complaisant, doux, affable.

T.

The Sum of all the Commandments is Charity.
Time stays for no Man.

Tenez votre Parole inviolablement.

V.

Vanity makes Beauty contemptible.
Vain are our Enjoyments.

Vivez sobrement si vous voulez avoir de longs Jours.

U.

Union and Peace make Discord to cease.
Understanding gets Favour.

Un Malheur ne vient jamais seul.

W.

Wisdom is more valuable than Riches.
Wisdom is commendable.

X.

Xenophon recommended Repentance to all Men.
Xenophon loved Learning.

Xénophon fut un Amateur des Sciences.

Y.

Your Memory with choicest Treasures store.
Youth wanteth Improvement.

Y a-t-il meilleur Préservatif que la Précaution?

Z.

Zeal in a good Cause will merit Applause.

Zealously

Zealously strive to mend.

Zénon fut le premier des Philosophes Stoïques.

EQUATION OF PAYMENTS

Is, when several Sums are due at different Times, to find a mean Time for paying the whole Debt.

RULE. Multiply each Term by its Time, and divide the Sum of the Products by the whole Debt, the Quotient is the mean Time.

EXAMPLES.

A owes C £ 300, whereof £ 100 is to be paid at 2 Months, £ 80 at 5 Months, and £ 120 at 10 Months, at what Time may the whole Debt be paid?

£				£
100	×	2	=	200
80	×	5	=	400
120	×	10	=	1200

3|00) 18|00

6 Months. Answer.

B owes C £ 500, whereof £ 90 is to be paid at 3 Months, £ 190 at 7 Months, and £ 220 at 11 Months; but they agree to make but one Payment of the Whole, what is the equated Time? *Answ.* $8\frac{1}{25}$ Months.

H is indebted to I a certain Sum, which is to be paid at two different Payments; that is, $\frac{1}{4}$ at 7 Months and $\frac{3}{4}$ at 11 Months; what is the equated Time to pay the Whole? *Answ.* 10 Months.

BARTER

Is the exchanging one Commodity for another. All Questions in this Rule may be solved by the Rule of Three.

EXAMPLES.

EXAMPLES.

What Quantity of Tobacco, at 1 s. 6 d. per lb. must be given in Barter for 3 cwt. of Tea, at 8 s. per lb. *Answ.* 1792 lb.

```
          3 cwt.
        112
        ---
        336 lb.
          8
       ----
       2688
 9 × 2 = 18     12
       -----
     9)32256 Pence.
      -----
     2)3584
      -----
       1792 lb.
```

How much Tea, at 8 s. per lb. must be given in Barter for 1792 lb. Tobacco, at 1 s. 6 d. per lb. *Ans.* 3 cwt.

1792 × 18 = 32256.

```
If  8 s. ——— 1 lb. ——— 32256 Pence.
   12                      1
   --                  --------(112)
   96                96)32256( 336 lb.
   --                   288     -----
                        ---     3 cwt. Answ.
                        345
                        288
                        ---
                         576
                         576
                         ---
                          ..
```

How many Dozen of Candles, at 7 s. 4 d. per Dozen, must be given in Barter for 4 cwt. 2 qrs. 17 lb. of Sugar, at $5\frac{1}{2}$ d. per lb.? *Answ.* 32 Doz. $6\frac{1}{2}$ lb.

How

How much Sugar, at $5\frac{1}{2}$ per lb. must be given in Barter for 32 Dozen and $6\frac{3}{4}$ lb. of Candles, at 7 s. 4 d. per Dozen? *Answ.* 4 cwt. 2 qrs. 17 lb.

A has Goods which cost him 16 s. B has Goods which cost him 20 s. now, if A puts his Goods at 20 s. and receives $\frac{1}{4}$ of this advanced Price in ready Money, how high ought B to rate his Goods to be even with A? *Answ.* $27\frac{3}{11}$ s.

How many Yards of Cloth, at 12s. must I give in Barter for 15 Yards at 5s. per Yard? *Answ.* $18\frac{3}{4}$ Y.

A and B barter; A hath $14\frac{1}{2}$ lb. of Pepper, at 1s. $7\frac{1}{2}$d. per lb. B hath Nutmegs, at 4s. 7d. per lb. what Quantity of Nutmegs must he deliver in Barter for the Pepper? *Answ.* $5\frac{31}{220}$ lb.

A has Pepper, which he barters at 6d. per lb. Profit; B has Nutmegs, which cost him 2s. 6d. per lb. but puts them at 3s. $1\frac{1}{2}$d. per lb. I demand the prime Cost of the Pepper? *Answ.* 2s.

M has Cotton, which he barters at $4\frac{1}{2}$d. per lb. Profit; N has Tobacco, which cost him 1s. 5 d. per lb. but charges 1s. 10d. per lb. I demand the prime Cost of the Cotton? *Answ.* $9\frac{1}{2}\frac{4}{7}$ d.

PROFIT AND LOSS

Is a Rule that discovers what is got or lost in the Buying or Selling of Goods.

Questions in this Rule are performed by the Rule of Three.

EXAMPLES.

If 1 lb. of Ginger cost 2s. and is sold for 2s. 6d. what is the Gain *per Cent.*? *Answ.* £ 25 *per Cent.*

If a Parcel of Cloth is sold for £ 250, and at 25 *per Cent.* Profit, what is the prime Cost? *Answ.* £ 200

A buys Cloth at 20 s. per Yard, and sells it to B at 30 s. per Yard; B, wanting Money, sells it again for 20 s. per Yard; I demand the Gain and Loss respectively with

with Regard to the Principal, and the Difference of the Sales *per Cent.?* *Answ.* A gains $\frac{1}{5}$, B loses $\frac{1}{3}$, Difference *per Cent.* $83\frac{1}{3}$

Bought 230 Yards of Cloth, at 5s. 6d. per Yard, and sold it for 7s. 6d. what was the Gain of the Whole? *Answ.* £ 23

Bought 200 Yards of Irish, at 2s. 6d. per Yard, and sold the same at 3s. 3d. per Yard, what is the Profit in the Whole, and how much *per Cent.?* *Answ.* Gain in the Whole, £ 7 10 0, and £ 30 *per Cent.*

Sold 1 Cwt. of Hops for £ 6 15 0, at the Rate of 25 *per Cent.* Profit, what would have been the Gain *per Cent.* if they had been sold for £ 8 per Cwt.? *Answ.* £ 48 2 $11\frac{1}{2}$

If a Yard of Cloth cost £ 1 6 8, and is sold for £ 1 12 0, what is the Gain *per Cent.?* *Answ.* £ 20

FELLOWSHIP

Is when two or more join their Stocks together. Fellowship is either with or without Time.

Rule. As the whole Stock is to the whole Gain or Loss, so is each Man's Stock to his Gain or Loss.

Proof. Add all the Shares together, (or say,) as the whole Gain or Loss is to the whole Stock, so is each Man's Share of the Gain or Loss to his Share of the Stock.

By this Rule a Bankrupt's Estate may be divided amongst his Creditors; as also Legacies, &c. may be adjusted when there is a Deficiency of Effects.

Examples.

Two Merchants trade together, A puts into Stock £ 40, B £ 80; they gained £ 50, what is each Person's Share of the Profit? *Answ.* A £ 16 13 4, B £ 33 6 8

As

£ £ £		£ £ £
As 120 — 50 — 40		As 120 — 50 — 80
40		80
12|0) 200|0(£ 16 13 4		12|0) 400|0(£ 33 6 8
12		36
80		40
72		36
8		4
20		20
160(13 s.		12|0) 80(6 s.
12		72
40		8
36		12
4		12) 96(8 d.
12		96
12) 48(4 d.		
48		

Three Persons trade together, X, Y, and Z; X puts in 40 l. Y 60 l. and Z 80 l. and they gained 180 l. what is each Man's Share of the Gain? *Answ.* X 40 l. Y 60 l. Z 80 l.

A's Stock is £ 120 16, B's £ 34 15, C's £ 100 13 6, and they gain £ 85 8 2, what is each Man's Share of the Gain? *Answ.* A £ 40 5 4, B £ 11 11 8, C £ 33 11 2

Four Merchants trade together, A, B, C, and D; A puts in 20 l. B 30 l. C 40 l. and D 60 l. and they lose 100 l. what is each Man's Share of the Loss? *Answ.* A £ 13 6 8, B £ 20 0 0, C £ 26 13 4, and D £ 40 0 0

D, E, and F, join Stocks; D's is £ 16 4 6, E's is £ 20 8 9, and F's is £ 36 15 9, and they lose by Trade £ 18 4 9, what is each Man's Loss? *Answ.* D £ 4 1 1½, E £ 5 2 2¼, F £ 9 1 5¼

Two Persons are to share a Legacy of £ 36 18 6; A is to have ½ when B has ¼, required each Man's Share?

Answ. A £ 24 12 4, B £ 12 6 2

D, E, and F, join Stocks in Trade; the Amount of their Stocks is £ 1294, and are in Proportion as 4, 6, and 8, are to one another, and the Amount of their Gain is equal to D's Stock, what is each Man's Stock and Gain?

	£	s.	d.			£	s.	d.	
D's	287	11	1 ¼ ⅓		Gain	63	18	0	The Fractions are equal to 1d. ¼ ⅓
E's	431	6	8			95	17	0	
F's	575	2	2 ½ ⅔			127	16	0	
£	1294	0	0	Proof.	£	287	11	0	

FELLOWSHIP WITH TIME.

RULE. Multiply every Man's Stock by his Time; then, as the Sum of these Products is to the whole Gain or Loss, so is each Man's Product to his Gain or *Loss*.

PROOF. As in Fellowship without Time.

EXAMPLES.

Three Merchants join in Company; D puts in Stock 20 l. for 3 Months, E puts in 30 l. for 4 Months, F puts in 40 l. for 6 Months, and they gain 50 l. what is each Man's Share of the Gain?

20×3 = 60
30×4 = 120
40×6 = 240

420–50–240

240
2000
100
42)1200|0(£ 28
84
360
336
24
20
42)480(11s.
42
60
42
18
12
42)216(5
210
6/42 = 1/7

As 420 – 50 – 60
60
42)300|0(£ 7
294
6
20
120(2s.
84
36
12
42)432(10d.
42
12
4
42)48(¼
42
6/42 = 1/7

As 420 – 50 – 120
120
42)600|0(£ 14
42
180
168
12
20
42)240(5s.
210
30
12
42)360(8d.
336
24
4
42)96(½
84
12/42 = 2/7

	£	s.	d.		
F	28	11	5	1/7	Gain.
E	14	5	8½	2/7	
D	7	2	10¼	1/7	
	£ 50	0	0		Proof.

A, B, and C, by a joint Stock, in a certain Time gain £ 116 4 0; A's Stock is 20 l. *per Cent.* more than B's, and B's Stock is 20 l. *per Cent.* more than C's; also A's Time is double B's, and B's Time is 1/3 of C's, I demand each Man's Share of the Gain?

Answ. A £ 47 5 4¼ 11/177, B £ 19 13 10¾ 81/177,
C 49 4 8¼ 141/177.

 Three

Three Merchants join in Company for 36 Months; D put in 1000 l. and at 10 Months End took out 400 l. at 20 Month's End put in 600 l. and at the End of 28 Months took out 260 l. E put in 800 l. and at the End of 6 Months 540 l. more; at 18 Months he took out 280 l. but put in 200 l. at the End of 24 Months, and withdrew 198 l. at the End of 30 Months: F put in 1800 l. and at 12 Months took out 400 l. at the End of 22 Months put in 1000 l. but took out that and 200 l. more at the End of 26 Months: They gained 200 l. I desire to know each Man's Share of the Gain?

		£	s.	d.
Answ.	D	50	7	6
	E	62	12	$5\frac{1}{4}$
	F	87	0	$0\frac{1}{4}$
	£	199	19	$11\frac{1}{2}$

—The Fractions are equal to $\frac{1}{2}$d.

A, B, and C, by a joint Stock, gain £ 284 5 4; A puts in £ 241 12 0 for 3 Months, B £ 69 10 0 for 9 Months, and C 201 7 0 for 6 Months; what is each Man's Share of the Gain? *Answ.* A £ 40 5 4 B £ 34 15 0, and C £ 67 2 4

A's Stock is £ 30 6 8, his Time 3 Months; B's Stock is £ 20 5 0, his Time 4 Months; C's Stock is £ 16 5 4, his Time 6 Months; they gain £ 67 10 0, I demand each Man's Gain? *Answ.* A's £ 22 15 0, B's £ 20 10 0, and C £ 24 5 0

ALLIGATION

Is either medial or alternate.

ALLIGATION MEDIAL

Is when the Price and Quantities of several Simples are given to be mixed, to find the mean Price of the Mixture.

RULE.

RULE. As the whole Composition is to its total Value so is any Part of the Composition to its mean Price.

PROOF. Find the Value of the whole Mixture at the mean Rate, and if it agrees with the total Value of the several Quantities, at their respective Prices, the Work is right.

EXAMPLES.

A Farmer mixed 30 Bushels of Wheat, at 4s. per Bushel, and 36 Bushels of Rye, at 3s. per Bushel, with 40 Bushels of Barley, at 2s. per Bushel, I desire to know the Worth of a Bushel of this Mixture? *Ans.* 2s. 10¾ $\frac{25}{53}$

As 106 : 308 :: 1
212
96
12
106)1152(10d.
106
92
4
368(3
318
50 $= \frac{25}{53}$
106

30 × 4 = 120
36 × 3 = 108
40 × 2 = 80
106 308 *Answ.* 2s. 10¾ $\frac{25}{53}$d.

A Grocer mixed 4 Cwt. of Sugar, at 58s. per Cwt. with 7½ Cwt. at 45s. per Cwt. and 3 Cwt. at 41s. per Cwt. I demand the Price of 3 Cwt. of this Mixture?

Answ. £. 7 3 3¼ $\frac{7}{29}$

A Vintner mixes 18 Gallons of Canary, at 5s. with 30 Gallons, at 7s. 6d. per Gallon, what is the Value of 1 Gallon of this Mixture? *Answ.* 6s. 6¾d.

A Grocer has Tea of 7s. 8s. 10s. and 13s. per lb. now, if he mix [illegible] lb. of the first, 3½ lb. of the second, 2[illegible] lb. of the third, and 1[illegible] lb. of the fourth, Sort together, I demand the Value of 1 lb. of the Mixture?

Answ. 9s. 6d.

A Refiner, having 18 lb. of Silver Bullion of 6 oz. fine, would melt it with 14 lb. of 8 oz. fine, and 10 lb. of 9 oz. fine, I require the Fineness of 1 lb. of this Mixture? *Answ.* $7\frac{8}{21}$ Ounces fine.

A Tobacconist would mix 40 lb. of Tobacco, at 13d. per lb. with 20 lb. at 15d. 25 lb. at 26d. per lb. and 30 lb. at 28d. per lb. what is the Worth of 1 lb. of this Mixture? *Answ.* $20\frac{2}{23}$ d.

A Malster mingles 30 Quarters of brown Malt, at 25s. per Quarter, with 20 Quarters of pale Ditto, at 30s. and 23 Quarters of high-dried Ditto, at 28s. what is the Value of 6 Bushels of this Mixture? *Answ.* £8 3 $10\frac{1}{2}$ $\frac{54}{73}$

Alligation Alternate

Is, when the Prices of several Things are given, to find such Quantities of them, to make a Mixture, as may bear a Price propounded.

I. In ordering the Rates and given Prices observe:

1. Place them one under the other, and the propounded Price or mean Rate on the Left-Hand of them.

2. Link the several Rates together, by 2 and 2, always observing to join a greater and a less than the mean Price.

3. Against each Extreme place the Difference of the mean and its Yoke Fellow.

	18	3
	19	6
22	25	4
	28	3

When the Prices of the several Simples and the mean Rate are given without any Quantity, to find how much of each Simple is required to compose the Mixture.

RULE. Take the Difference between each Price and the mean Rate, and set them alternately, they will be the Answer required.

PROOF. By Alligation medial.

Examples.

A Vintner would mix four Sorts of Wine together, of 18d. 19d. 25d. and 28d. per Quart, what Quantity of each must he take to sell the Mixture at 22d. per Quart?

Answer.

Answer.

d.	q.	d.	d.
18	3 of	18 =	54
22 19	6 of	19 =	114
25	4 of	25 =	100
28	3 of	28 =	84
	16		352
			22d.

Or thus.

d.	q.	d.	d.
18	6 of	18 =	108
22 19	3 of	19 =	57
25	3 of	25 =	75
28	4 of	28 =	112
	16		352
			22

Note. Questions in this Rule admit of a great Variety of Answers, according to the Manner of linking them.

A Grocer would mix Sugar, at 5d. 7d. and 9d. per lb. together, so as to sell the Compound at 8½ per lb. what Quantity of each must he take? *Answ.* ½ lb. at 5d. ½ lb. at 7d. and 5 lb. at 9d.

I desire to know how much Tea, at 15s. 17s. and 19s. per lb. will make a Mixture worth 16s. per lb.? *Answ.* 4 lb. at 15s. 1 lb. at 17s. and 1 lb. at 19s.

Mix Tea of 7s. 9s. 12s. and 15s. to make a Compound of 10s. *Answ.* [illegible] lb. at 7s. 5 lb. at 9s. 3 lb. at 12s. and 1 lb. at 15s.

ALTERNATION, PARTIAL,

Is when the Prices of all the Simples, the Quantity only of one of them, and the mean Rate, are given, to find the several Quantities of the Rest in Proportion to that given.

RULE. Take the Difference between each Price and the mean Rate as in the Rule before; Then, as the Difference of that Simple, whose Quantity is given, is to the Rest of the Differences severally, so is the Quantity given to the Quantities required.

EXAMPLES.

A Grocer, having determined to mix 30 lb. of Sugar, at 10d. per lb. with other, at 7d. 6d. and 9d. how many Pounds

Pounds of each Sort must he take to make one Pound of that Mixture worth 8d. per Pound?

				lb.		d.	d.	
	d.							
	10	1 2 3=6		30	at	10 :	300	As 6 : 2 :: 30
8	7	2	2	10	at	7 :	70	As 6 : 2 :: 30
	6	2	2	10	at	6 :	60	As 6 : 2 :: 30
	5	2	2	10	at	5 :	50	
				60			480(8d.	Proof.
							480	

A Distiller would mix 60 Gallons of French Brandy, at 13s. per Gallon, with English, at 7s. and Spirits, at 5s. what Quantity of each Sort must he take to make 1 Gallon worth 9s.? *Answ.* 60 Gall. at 13s. 40 Gall. at 7s. and 40 Gall. at 5s.

A Wine-Merchant is desirous of mixing 20 Gallons of Canary, at 7s. per Gallon, with Malaga, at 8s. 6d. per Gall. Sherry, at 5s. 6d. and Mountain, at 4s. 8d. per Gall. how much of each Sort must he take to make the Mixture worth 6s. 6d. per Gallon? *Answ.* 20 Gall. at 7s. 36⅔ Gall. Malaga, 10 Gall. Sherry, and 40 Gall. Mountain.

If I mix Wheat, at 5s. per Bushel; Rye, at 4s. per Bushel; and Barley, at 3s. with 20 Bushel of Oates, at 2s. per Bushel, how many Bushels of each Sort must I take to make the Mixture worth 3s. 6d. the Bushel?
Answ. 20 B. of Wheat, 60 of Rye, 60 of Barley, and 20 of Oates.

If I mix Teas, of 13s. 15s. 17s. and 19s. per lb. with 12 lb. at 20s. per lb. how many Pounds of each Sort must I take to make a Mixture worth 16s. per lb.?
Answ. 16 lb. at 13s. 12 lb. at 15s. 12 lb. at 17s. 8 lb. at 19s. and 12 lb. at 20s.

Alternation, Total,

Is when the Price of each Simple, the Quantity to be compounded, and the mean Rate, are given, to find how much of each Sort will make that Quantity.

Rule

Rule. Take the Difference between each Price and the Mean Rate as before: Then, as the Sum of the Difference is to each particular Difference, so is the Quantity given to the Quantity required.

Examples.

A Druggist has four Sorts of Drugs, *viz.* of 3s. 5s. 8s. and 10s. *per* lb. and would make a Composition of 100lb. worth 7s. *per* lb. I desire to know what Quantity of each he must take.

	3	1	10 at 3s. = 30s.	As 10 : 1 :: 100 : 10
	5	3	30 at 5s. = 150s.	As 10 : 3 :: 100 : 30
7	8	4	40 at 8s. = 320s.	As 10 : 4 :: 100 : 40
	10	2	20 at 10s. = 200s.	As 10 : 2 :: 100 : 20
		10	100	) 700(7s.
				700 *Proof.*

A Grocer has four Sorts of Sugar, *viz.* of 12d. 11d. 9d. and 5d. *per* lb. and would make a Composition of 60 lb. worth 7d. *per* lb. I demand what Quantity he must take of each? — *Answ.* $7\frac{1}{17}$ lb. at 12d. $7\frac{1}{17}$ lb. at 11d. $7\frac{1}{17}$ lb. at 9d. and $38\frac{14}{17}$ lb. at 5d.

A Silversmith has four Sorts of Gold, *viz.* of 23, of 20, of 16, and of 15 Carats fine, and would mix as much of each Sort together as to make 42 oz. of 19 Carats fine; how much must he take of each? — *Answ.* 14 oz. of 23 Carats fine, $10\frac{1}{2}$ oz. at 20 Carats, $3\frac{1}{2}$ oz. at 16 Carats, and 14 oz. at 15 Carats.

POSITION, OR THE RULE OF FALSE.

This Rule is called False Position; because, by a false Number the true one is found.

Rule. 1. Suppose a Number, and work with it as the true. 2. Then, as the Total of the Errors is to the true

true Total, so is the supposed Number to the true one required.

PROOF. Add the several Parts of the Sum together; and, if it agree with the Sum, it is right.

EXAMPLES.

A Gentleman delivered to his Friend a Sum of Money unknown, to receive Interest for the same at 5 *per Cent. per Annum*, Simple-Interest, and at the End of 7 Years received, for Principal and Interest, £ 220; what was the Sum lent? *Answ.* £ 162 19 $3\frac{15}{135}$.

Suppose £ 100
5 Rate *per Cent.*

500
7 Number of Years.

35|00
100

As £ 135 —— £ 220 —— £ 100
100

135)22000

£ 162 19 $3\frac{15}{135}$ *Answ.*

A Drover, who took 121 Sheep to Market, being asked how many he had sold, answered, on Monday I sold $\frac{1}{4}$, on Tuesday $\frac{2}{3}$, on Wednesday $\frac{1}{7}$, of the Number I have left: If I gave him £ 15 15 0 for them the Drover had left, at what Rate did I buy them *per* Sheep?
Answ. £ 1 6 $9\frac{3}{4}$ $\frac{35}{121}$.

A Person, having about him a certain Number of Guineas, said, if the 4th, 5th, and 8th, were added together, they would make 23; how many had he?
Answ. 40.

A Gentleman bought a Coach, Horses, and Harness, for £ 120; the Horses cost twice the Price of the Harness, and the Coach twice the Price of the Horses and Harness;

Harness: What did he give for each? — *Answ.* Horses £ 26 13 4; Harness £ 13 6 8; Coach £ 80.

DOUBLE POSITION

Is by using two supposed Numbers; and, if both prove false, they are, with their Errors, to be thus ordered.

RULE. 1. Place each Error against its respective Position.

2. Multiply them cross-wise.

3. If the Errors be alike, (*i. e.* both greater or both less than the given Number,) take their Difference for a Divisor, and the Difference of their Products for a Dividend; but, if unlike, take their Sum for a Divisor, and the Sum of their Products for a Dividend: The Quotient will be the Answer.

EXAMPLES.

Three Persons discoursing about their Ages, says A, I am 25 Years of Age; says B, I am as old as C and A; and says C, I am Half the Age of you both: I demand the Age of A, B, and C, severally.

Answ. A 25, B 75, and C 50.

Suppose B 60   Suppose B 90
C 40   C 60
A 20   A 30

Divisor.
120 — 5 × 60   180 + 5 and 5 added = 10
5 × 90

450
300

10)750(75 B.

A, B, and C, would divide £ 100 between them, so that B may have £ 7 more than A, and C £ 9 more than B: How much must each have? — *Answ.* A £ 25 13 4, B £ 32 13 4, C £ 41 13 4.

A

A Goldsmith has two Gold Cups of unequal Weight, having one Cover to both of 9 oz. Now, if the Cover be put on the smaller Cup, it will be ½ the Weight of the greater Cup; and, set on the greater Cup, it will be 3 Times the Weight of the smaller Cup: What is the Weight of each Cup? — *Answ.* Little Cup 27 oz. great Cup 72 oz.

Two Persons discoursing, says B to C, if I had 8 of your Sheep, I should have as many as you; says C to B, if I had 8 of yours, I should have twice as many as you: How many had B and C severally? *Ans.* B 40, C 56.

Having caught a Whale whose Head is 9 Feet long, I find the Tail is as long as the Head and Half the Body, and the Body as long as the Head and Tail: I demand the Length of the Fish. — *Answ.* 72 Feet long; *viz.* the Head 9 Feet, Tail 27 Feet, Body 36 Feet.

A Son asking his aged Father how old he was, the Father replied, your Age is now ⅓ of mine, and 7 Years ago your Age was only ⅙ of mine: I demand what were their Ages then? *Ans.* Father's 168, Son's 28.

EXCHANGE

Is the receiving Mony in one Country for the same Value paid in another.

I. FRANCE.

They keep their Accounts, at *Paris*, &c. in Livres, Sols, and Deniers, and Exchange by the Crown, equal to 4s. 6d. at Par.

Note. 12 Deniers make 1 Sol.
20 Sols – – 1 Livre.
3 Livres – – 1 Crown.

To change French into Sterling.

RULE. As 1 Crown is to the given Rate, so is the Sum French to the Sterling required.

To change Sterling into French.

Rule. As the Rate of Exchange is to 1 Crown, so is the Sum Sterling to the French required.

Examples.

How many Crowns must be paid at *Paris*, to receive in *London* £. 90, Exchange at 4s. 6d. *per* Crown?

```
      d.   cr.   £.
As 54 : 1 :: 90 :
             240
         -------
     54)21600
         -------
           400 Cr.
```

How many Pounds Sterling must be paid in *London*, to receive at *Paris* 400 Crowns? *Ans.* £. 90.

```
     cr.  d.    cr.
As 1 : 54 :: 400 :
             400
          -------
     12)21600
          -------
    2|0)180|0
          -------
          £. 90 Ans.
```

How many Pounds Sterling in 486 French Crowns, 2 Livres, 10 Sols, 6 Deniers, Exchange at 4s. 6d. Sterling *per* Crown? *Ans.* £. 106 8 $3\frac{9}{20}$.

How much Sterling must be paid in *London*, to receive in *Paris* 640 Crowns, Exchange at 55d. *per* Crown? *Ans.* £. 146 13 4.

A Merchant in *London* remits to his Correspondent at *Paris* £. 146 13 4, Exchange at 55d. *per* Crown: What is the Value in French Crowns? *Ans.* 640 Crowns.

II. Spain.

Accounts are kept, at *Madrid*, *Cadiz*, &c. in Dollars, Rials, and Maravedies; Exchange by the Piece of Eight or Piastre, equal to 4s. 6d. at Par.

Note. 34 Maravedies make 1 Rial.
8 Rials - - - - 1 Piastre or Piece of Eight.
10 Rials - - - - 1 Dollar.

Rule. As before.

Examples.

A Merchant at *Cadiz* remits to *London* 1400 Piastres, at 56d. *per* Piastre: How much Sterling is the Sum?

Ans. £ 326 13 4.

How many Pieces of Eight will answer a Bill of £ 326 13 4, Exchange at 56d. each? *Ans.* 1400.

III. Portugal.

Accounts are kept, at *Lisbon*, &c. in Reas; and Exchange on the Milrea, equal to 6s. 8½d. at Par.

Note. 1000 Reas make 1 Milrea.

Rule. As before.

Examples.

A Merchant at *Lisbon* remits to his Correspondent in *London* 1470 Milreas, Exchange at 6s. 5¼d. *per* Milrea: How much Sterling is the Sum? *Ans.* £ 476 4 4½.

If a Bill be drawn, from *London* on *Lisbon*, for £ 476 4s. 4½d. Sterling, how many Milreas, at 6s. 5¼d. are equal in Value to the Sum? *Ans.* 1470 Milreas.

If I pay a Bill at *London* of £ 80, what must I draw for on my Correspondent at *Lisbon*, Exchange at 5s. 8⅜d. *per* Milrea. *Ans.* 280 Milreas and 64$\frac{132}{617}$ Reas.

IV. Holland, Flanders, *and* Germany.

Accounts are kept, at *Antwerp*, *Amsterdam*, *Brussels*, &c. some in Pounds, Shillings, and Pence, as in *England*; others in Guilders, Stivers, and Pennings; and the Exchange is made with us on our Pound, at 33s. 4d. Flemish, at Par.

Note. 8 Pennings make 1 Groat.
2 Groats – – 1 Stiver.
20 Stivers – – 1 Guilder or Florin.

Also,
12 Groats or 6 Stivers – – 1 Schelling.
20 Schellings or 6 Guilders – 1 Pound.

To change Flemish into Sterling.

RULE. As the given Rate is to 1 Pound, so is the Flemish Sum to the Sterling required.

To change Sterling into Flemish.

RULE. As £ 1 Sterling is to the given Rate, so is the Sterling given to the Flemish sought.

EXAMPLES.

If *London* exchange with *Hamburgh* at 33 s. 4 d. Flemish *per* Pound Sterling, what is the Value of 721 Guilders 10 Stivers? *Ans.* £ 72 3 0

What is the Sterling Value of a Guilder and Stiver severally, if £ 72 3 0 Sterling be equal to 721 Guilders 10 Stivers?—*Ans.* A Guilder 2 s. and a Stiver $1\frac{1}{5}$ d. Ster.

If *Hamburgh* exchange with *London* at 33 s. 4 d. *per* Pound Flemish, what is the Value of £ 72 3 0 Sterling in Flemish Money? *Ans.* £ 120 5

To convert Bank-Money into current, and vice versa.

Note. Bank Money is worth more than current: The Difference is generally from 3 to 6 *per Cent.* in Favour of Bank, called Agio.

To change Bank into current Money.

RULE. As 100 Guilders Bank is to 100, with the Agio, so is the given Bank to the current Money required.

To change current Money into Bank.

RULE. As 100, with the Agio, is to 100 Bank, so is the current Money given to the Bank required.

Change 1589 Guilders, 10 Stivers, current Money, into Bank Florins, Agio $4\frac{1}{2}$ *per Cent.*

Answ. 1522 Flo. 17 Stiv. 0 Groats, $7\frac{127}{167}$ Pennings.

In 1522 Guilders, 17 Stivers, $7\frac{127}{167}$ Pennings, Bank, how much current Money? *Answ.* 1589 Guild. 10 Stiv.

V. Ireland.

Examples.

If I remit to *Ireland* £ 100 18 Sterling, what will my Friend receive there, the Exchange being at 7 *per Cent.*?

Answ. £ 107 19 $3\frac{3}{25}$

What must be paid in *London* for a Remittance of £ 107 19s. $3\frac{3}{25}$ d. *Irish*; Exchange at 7 *per Cent.*?

Answ. £ 100 18 0

COMPARISON of WEIGHTS and MEASURES.

Rule. As the first Comparisons are to one another, so is the third Number to the Number required.

Examples.

If 20 *Dutch* Pence be worth 40 *French* Pence, how many *Dutch* Pence are equal to 200 *French* Pence?

Comparisons.

	French.		Dutch.		French.	
If	40	——	20	——	200.	— Third Number.
			200			
			4)400|0			
			100	Dutch. Answer.		

If 200 *French* Pence be equal to 100 *Dutch* Pence, how many *Dutch* Pence are equal to 40 *French* Pence? *An.* 20

Conjoined Proportion

Is when Coin, Weight, or Measure, of several Countries are compared in the same Question.

When

When it is required to find how many of the first Sort of Coin, Weight, or Measure, mentioned, are equal to the given Quantity of the last.

Rule. Place the Numbers alternately, beginning at the Left-Hand, and let the last Number stand on the Left-Hand; then multiply the first Row continually for a Dividend and the second for a Divisor.

Proof. By as many single Rules of Three as the Question requires.

Examples.

If 10 lb. at *London* make 14 lb. at *Amsterdam*, and 100 lb. at *Amsterdam* 130 at *Paris*, how many Pounds at *London* are equal to 70 at *Paris*? *Answ.* $38\frac{6}{13}$ lb.

Left.	Right.	
10	14	$14 \times 130 = 1820$ Divisor.
100	130	
70	————	$70 \times 100 \times 10 =) 70000 (38$

$$
\begin{array}{r}
70000\,(38 \\
5460 \\
\hline
15400 \\
14560 \\
\hline
840 \\
\hline
1820
\end{array}
= \frac{6}{13}
$$

If 130 lb. at *Paris* are equal to 100 at *Amsterdam*, and 14 lb. at *Amsterdam* are equal to 10 lb. at *London*, how many Pounds at *Paris* are equal to $38\frac{6}{13}$ at *London*?

Answ. 70 lb. at *Paris*.

When it is required to find how many of the last Sort of Coin, &c. mentioned, is equal to a Quantity of the first.

Rule. Place the Numbers alternately, beginning at the Left-Hand, and let the last Number stand on the Right-Hand; then multiply the first Row for a Divisor and the second for a Dividend.

EXAMPLES.

If 14 lb. at *London* make 10 at *Amsterdam*; 100 lb. at *Amsterdam* 130 at *Paris*; how many Pounds at *Paris* are equal to $38\frac{6}{13}$ at *London*? *Answ.* $35\frac{10}{14}$ lb.

Left.	Right.
14	10
100	130

$$\frac{38\frac{6}{13} \times 130 \times 10 = 50000}{100 \times 14 = 1400} = 35\tfrac{10}{14}. \quad \textit{Ans.}$$

If 20 lb. at *London* make 30 at *Paris*, and 40 lb. at *Paris* 50 at *Amsterdam*, how many Pounds at *Amsterdam* are equal to 20 Pounds at *London*? *Answ.* $37\frac{1}{2}$ lb.

ARITHMETICAL PROGRESSION

Is when a Rank of Numbers increase or decrease regularly, by the continual adding or subtracting of the equal Number; as 1, 2, 3, 4, 5, 6, are in arithmetical Progression by the continual increasing or adding of one, and 11, 9, 7, 5, 3, 1, by the continual Decrease or Subtraction of two.

Note. When any even Number of Terms differs by arithmetical Progression, the Sum of the two Extremes will be equal to the two middle Numbers, or any two Means equally distant from the Extremes; as 2, 4, 6, 8, 10, 12, where $6+8$, the two middle Numbers, are $= 12+2$, the two Extremes, and $= 10+4$ the two Means $= 14$.

When the Number of Terms are odd, the Double of the middle Term will be equal to the two Extremes, or of any two Means equally distant from the middle Term; as 1, 2, 3, 4, 5, where the Double of $3 = 5+1 = 2+4 = 6$.

EXAMPLES.

What is the Sum of the Numbers 1, 2, 3, &c. to 2500? *Answ.* 3126250.

$$2500 + 1 \times \tfrac{2500}{2} = 3126250.$$

A Man bought 19 Yards of Cloth, and gave 4 s. for the first Yard and 12s. for the last, what did the 19 Yards cost? *Answ.* £ 7 12 0

19 × 8 = 152 s.

A Man had 12 Sons, the youngest 5 Years old and the eldest 40, and they increased in arithmetical Progression, what was the common Difference of their Ages? *Answ.* $3\frac{2}{11}$ Years.

$40 - 5 \div 11 = 3\frac{2}{11}$ Years.

A Gentleman, travelling into the Country, went 5 Miles the first Day, and increased every Day by 5 Miles, till at last he went 80 Miles in one Day, how many Days did he travel? *Answ.* 16 Days.

A Man, in 13 Days, went from *London* to *Edinburgh*, every Day's Journey increasing the former by 4 Miles, and the last Day he went 56 Miles, what was the first Day's Journey? *Answ.* 8 Miles.

If I receive 100 l. at 12 several Payments, each to exceed the former by 4 l. and am willing to bestow the first Payment on any one that can tell me what it is, what will he have for his Pains? *Answ.* £ 1 1 0 0

What is the last Number of an arithmetical Progression, beginning at 4, and continuing by the Increase of 6 to 20 Places? *Answ.* 118.

GEOMETRICAL PROGRESSION

Is the Increasing or Decreasing of any Rank of Numbers by some common Ratio; that is, by the continual Multiplication or Division of some equal Number; as 2, 4, 8, 16, 32, increased by the Multiplier 2; and 32, 16, 8, 4, 2, decreased by the Divisor 2.

Rule.

1. If the common Multiplier be involved to the Power whose Exponent is the Number of Terms — 1, and that Power multiplied into the first Term, the Product will be the last; or if the last Term be divided by that Power, the complete Quotient will be the first.

2.

2. If the Difference of the Extremes be divided by the Difference between the common Multiplier and Unity, and the complete Quotient be added to the last Term, the Result will be the Sum of all the Terms.

EXAMPLES.

What is the Sum of 14 Terms of the Progression 4, 12, 36, &c.? *Answ.* 9565932

0, 1, 2, 3, 4, 5, Exponents. 972
4, 12, 36, 108, 324, 972 972

First Term 4)944784=10

5+5=10+3=13 N°. of Terms less 1. 236196

108=3

4)25509168

6377292

4

Common Multiplier 3)6377288

Less — 1 —

3188644

Ans. 9565932

A Lady agrees for 17 Yards of Silk at a Mercer's, to pay ¼ d. for the first Yard, 2 d. for the second, 16 d. for the 3 d. and so in Proportion to the last: What will the last Yard cost? *Ans.* £ 293203100740 5 4

A Gentleman, dying, left 4 Sons, to whom, and to his Executors, he bequeathed his Estate, in Manner following; to his Executors £ 30, his youngest Son £ 60, and doubling it to the last: What was the eldest Son's Portion? *Ans.* £ 480.

A Gentleman married his Daughter on New Year's Day, and gave her Husband £ 1 towards her Portion, promising to treble it on the first Day of every Month for one Year: What was her Portion? *Ans.* £ 13286 0 0

PER-

PERMUTATION

Is the changing or varying the Order of Things.

Rule. Multiply all the given Terms one into another, and the last Product will be the Number of Changes required.

Examples.

How many Changes may be rung on 6 Bells? *Ans.* 720.

$1 \times 2 \times 3 \times 4 \times 5 \times 6 = 720$ Changes.

If a Church has 7 Bells, how many Changes may be rung upon them? *Ans.* 5040.

THE

THE Preceptor's Assistant, OR, SCHOOLMASTER's GUIDE.

PART II.

VULGAR FRACTIONS.

A Fraction is a Part or Parts of an Unit or 1, and written with two Figures and a Line between them; as, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$, *&c.* The upper Figure is called the Numerator, and the under one the Denominator, which shews how many Parts the Unit is divided into; and the Numerator shews how many of those Parts are meant by the Fraction.

There are four Sorts of Vulgar Fractions; proper, improper, compound, and mixed; *viz.*

1. A proper Fraction is when the Numerator is less than the Denominator; as, $\frac{1}{2}$, $\frac{2}{7}$, $\frac{5}{9}$, *&c.*

2. An improper Fraction is when the Numerator is equal to, or greater than, the Denominator; as, $\frac{5}{3}$, $\frac{4}{1}$, $\frac{7}{3}$, *&c.*

3. A compound Fraction is the Fraction of a Fraction, and known by the Word *of*; as, $\frac{1}{3}$ of $\frac{2}{5}$ is = to $\frac{2}{15}$, *&c.*

4. A mixed Number is composed of a whole Number and a Fraction; as, $3\frac{5}{9}$, $4\frac{6}{8}$, *&c.*

REDUCTION IN VULGAR FRACTIONS.

RULE. Multiply each Numerator into all the Denominators, except its own, for a new Numerator, and all the Denominators for a common Denominator.

EXAMPLES.

EXAMPLES.

Reduce $\frac{2}{3}$ and $\frac{3}{5}$ to a common Denominator.

$2 \times 5 = 10.$

$3 \times 3 = 9.$ *Answ.* $\frac{10}{15}$ and $\frac{9}{15}$.

$3 \times 5 = 15$, common Denominator.

Reduce $\frac{1}{3}$, $\frac{5}{9}$, and $\frac{6}{8}$, to a common Denominator.

Facit $\frac{72}{312}$, $\frac{160}{312}$, $\frac{216}{312}$.

Reduce $\frac{3}{6}$, $\frac{1}{3}$, $\frac{48}{112}$, and $\frac{5}{8}$, to a common Denominator.

Facit $\frac{504}{1008}$, $\frac{336}{1008}$, $\frac{432}{1008}$, $\frac{630}{1008}$.

Reduce $\frac{4}{7}$, $\frac{5}{9}$, $\frac{6}{7}$, and $\frac{3}{8}$, to a common Denominator.

Facit $\frac{2016}{3528}$, $\frac{1960}{3528}$, $\frac{3024}{3528}$, $\frac{1323}{3528}$.

Reduce $\frac{3}{4}$, $\frac{5}{6}$, $\frac{1}{2}$, and $\frac{2}{3}$, to a common Denominator.

Facit $\frac{108}{144}$, $\frac{120}{144}$, $\frac{72}{144}$, $\frac{96}{144}$.

Reduce $\frac{1}{2}$, $\frac{4}{7}$, $\frac{2}{3}$, and $\frac{6}{8}$, to a common Denominator.

Facit $\frac{84}{168}$, $\frac{96}{168}$, $\frac{112}{168}$, $\frac{126}{168}$.

2. *To reduce a vulgar Fraction to its lowest Terms.*

RULE. Find a common Measure, by dividing the lower Term by the upper, and that Divisor by the Remainder following till Nothing remain, the last Divisor is the common Measure; then divide both Parts of the Fraction by the common Measure, and the Quotient will give the Fraction required.

Note. If the common Measure is 1 the Fraction is in its lowest Term: When a Fraction hath Ciphers at the Right-Hand it may be abbreviated thus: $\frac{3|0}{4|0}$

EXAMPLES.

Reduce $\frac{48}{64}$ to its lowest Terms.

Then $16)\frac{48}{64} = \frac{3}{4}$. *Facit.*

```
48)64(1
   48
   --
16)48(3
   48
   --
```

Reduce $\frac{30}{90}$ to its lowest Terms. *Answ.* $\frac{1}{3}$.

Reduce $\frac{205}{1586}$ to its lowest Terms. *Answ.* $\frac{205}{1586}$.

Reduce

Reduce $\frac{20}{100}$ to its lowest Terms. *Answ.* $\frac{1}{5}$.

Reduce $\frac{90}{180}$ to its lowest Terms. *Answ.* $\frac{1}{2}$.

3. *To reduce a mixed Number to an improper Fraction.*

RULE. Multiply the whole Number by the Denominator of the Fraction, to which add the Numerator for a new Numerator, then place it over the Denominator.

EXAMPLES.

Reduce $12\frac{5}{9}$ to an improper Fraction. *Answ.* $\frac{113}{9}$.

$$12 \times 9 + 5 = \frac{113}{9}.$$

Reduce $25\frac{3}{7}$ to an improper Fraction. *Answ.* $\frac{178}{7}$.

Reduce $120\frac{5}{8}$ to an improper Fraction. *Answ.* $\frac{965}{8}$.

Reduce $57\frac{12}{13}$ to an improper Fraction. *Answ.* $\frac{753}{13}$.

4. *To reduce an improper Fraction to its proper Terms.*

RULE. Divide the upper Term by the lower.

EXAMPLES.

Reduce $\frac{113}{9}$ to its proper Terms. *Answ.* $12\frac{5}{9}$.

$$113 \div 9 = 12\frac{5}{9}.$$

Reduce $\frac{178}{7}$ to its proper Terms. *Answ.* $25\frac{3}{7}$.

Reduce $\frac{965}{8}$ to its proper Terms. *Answ.* $120\frac{5}{8}$.

Reduce $\frac{753}{13}$ to its proper Terms. *Answ.* $57\frac{12}{13}$.

5. *To reduce a compound Fraction to a single one.*

RULE. Multiply all the Numerators for a new Numeration, and all the Denominators for a new Denominator.

EXAMPLES.

Reduce $\frac{1}{2}$ of $\frac{5}{7}$ of $\frac{4}{8}$ to a single Fraction. *Answ.* $\frac{5}{28}$.

$$\frac{1 \times 5 \times 4}{2 \times 7 \times 8} = \frac{20}{112} \text{ reduced, by Rule 2, } = \frac{5}{28}.$$

Reduce $\frac{2}{5}$ of $\frac{4}{7}$ of $\frac{3}{9}$ of $\frac{5}{6}$ to a single Fraction. *An.* $\frac{10}{189}$.

Reduce $\frac{3}{5}$ of $\frac{1}{3}$ of $\frac{4}{6}$ to a single Fraction. *Answ.* $\frac{2}{15}$.

6. To

6. *To reduce Fractions of one Denomination to the Fractions of another, retaining the same Value, but greater.*

Rule. Reduce the given Fraction to a compound one, by comparing it with all the Denominations between it and that Denomination which you would reduce it to; then reduce that compound Fraction to a single one.

Examples.

Reduce $\frac{5}{9}$ of a Penny to the Fraction of a Pound.

Answ. $\frac{5}{2160}$.

$$\frac{5}{9} \times \frac{1}{12} \times \frac{1}{20} = \frac{5}{2160}.$$

Reduce $\frac{3}{5}$ of a Shilling to the Fraction of a Pound.

Answ. $\frac{1}{80}$.

Reduce $\frac{1}{4}$ of a Pound Avoirdupoise to the Fraction of 1 cwt.

Answ. $\frac{1}{448}$.

7. *To reduce Fractions of one Denomination to the Fractions of another, but less, retaining the same Value.*

Rule. Multiply the Numerator by the Parts contained in the several Denominations between it and that you would reduce it to, for a new Numerator, and place it over the given Denominator.

Examples.

Reduce $\frac{5}{2160}$ of a Pound to the Fraction of a Penny.

Answ. $\frac{5}{9}$.

$\frac{5}{2160} \times 20 \times 12 = \frac{1200}{2160}$; reduced, equal to $\frac{5}{9}$.

Reduce $\frac{1}{80}$ of a Pound to the Fraction of a Shilling.

Answ. $\frac{1}{4}$.

Reduce $\frac{1}{448}$ of a Cwt. to the Fraction of a Pound Avoirdupoise.

Answ. $\frac{1}{4}$.

8. *To reduce Fractions of one Denomination to others of the same Value, having the Numerator given of the required Fraction.*

RULE. As the Numerator of the given Fraction is to its Denominator, so is the Numerator of the intended Fraction to its Denominator.

EXAMPLES.

Reduce $\frac{5}{7}$ to a Fraction of the same Value, whose Numerator shall be 15. As 5 : 7 :: 15. *Ans.* $\frac{15}{21}$.

Reduce $\frac{3}{4}$ to a Fraction of the same Value, whose Numerator shall be 12. *Answ.* $\frac{12}{16}$.

Reduce $\frac{1}{7}$ to a Fraction of the same Value, whose Numerator shall be 11. *Answ.* $\frac{11}{77}$.

9. *To reduce Fractions of one Denomination to others of the same Value, having the Denominator given of the Fraction required.*

RULE. As the Denominator of the given Fraction is to its Numerator, so is the Denominator of the intended Fraction to its Numerator.

EXAMPLES.

Reduce $\frac{5}{7}$ to a Fraction of the same Value, whose Denominator shall be 21. As 7 : 5 :: 21. *Answ.* $\frac{15}{21}$.

Reduce $\frac{3}{4}$ to a Fraction of the same Value, whose Denominator shall be 16. *Answ.* $\frac{12}{16}$.

Reduce $\frac{1}{7}$ to a Fraction of the same Value, whose Denominator shall be 77. *Answ.* $\frac{11}{77}$.

10. *To reduce a mixed Fraction to a single one.*

RULE. When the Numerator is the integral Part, multiply it by the Denominator of the fractional Part; to which add the Numerator of the fractional Part for a new Numerator; then multiply the Denominator of the Fraction by the Denominator of the fractional Part for a new Denominator.

K EXAMPLES.

EXAMPLES.

Reduce $\frac{20\frac{5}{8}}{45}$ to a simple Fraction. *Answ.* $\frac{33}{72}$.

$$\begin{array}{l} 20 \times 8 + 5 = \\ 45 \times 8 \quad = \end{array} \frac{165}{360} \text{ reduced } = \frac{33}{72}.$$

Reduce $\frac{25\frac{4}{5}}{35}$ to a simple Fraction. *Answ.* $\frac{129}{175}$.

When the Denominator is the integral Part, multiply it by the Denominator of the fractional Part, adding the Numerator of the fractional Part for a new Denominator; then multiply the Numerator of the Fraction by the Denominator of the fractional Part for a new Numerator.

EXAMPLES.

Reduce $\frac{28}{35\frac{4}{7}}$ to a simple Fraction. *Answ.* $\frac{196}{249}$.

$$\begin{array}{l} 28 \times 7 \quad = \\ 35 \times 7 + 4 = \end{array} \frac{196}{249}.$$

Reduce $\frac{17}{40\frac{5}{8}}$ to a simple Fraction. *Answ.* $\frac{136}{325}$.

II. *To find the proper Quantity of a Fraction in the known Parts of an Integer.*

RULE. Multiply the Numerator by the common Parts of the Integer, and divide by the Denominator.

EXAMPLES.

Reduce $\frac{3}{8}$ of a Pound Sterling to its proper Quantity.

$3 \times 20 = 60 \div 8 = 7^{s.}\ 6d.$ *Answ.* $7^{s.}$ 6d.

Reduce $\frac{3}{7}$ of a Pound Avoirdupoise to its proper Quantity. *Answ.* 6 oz. $13\frac{5}{7}$ drms.

Reduce $\frac{8}{10}$ of a Hundred Weight to its proper Quantity. *Answ.* 3 qrs. 5 lb. 9 oz. $9\frac{3}{5}$ drms.

 Reduce

Reduce $\frac{4}{9}$ of an Ell English to its proper Quantity.

Answ. $2\frac{2}{9}$ qrs.

Reduce $\frac{3}{8}$ of a Mile to its proper Quantity.

Answ. 3 Furlongs.

Reduce $\frac{7}{8}$ of a Year to its proper Quantity.

Answ. 10 Months, $19\frac{3}{8}$ Days.

12. *To reduce any given Quantity to the Fraction of any greater Denomination, retaining the same Value.*

Rule. Reduce the given Quantity to the lowest Term mentioned for a Numerator, under which set the Denominator, and it will give the Fraction required.

Examples.

Reduce 7s. 6d. to the Fraction of a Pound Sterling.

Answ. $\frac{3}{8}$.

Reduce 6 oz. $13\frac{5}{7}$ drms. to the Fraction of a Pound Avoirdupoise.

Answ. $\frac{3}{7}$.

Reduce 3 qrs. 5 lb. 9 oz. $9\frac{3}{5}$ drms. to the Fraction of a Hundred Weight.

Answ. $\frac{4}{5}$.

Reduce $2\frac{2}{9}$ qrs. to the Fraction of an Ell *English*.

Answ. $\frac{4}{9}$.

Reduce 3 Furlongs to the Fraction of a Mile. *Ans.* $\frac{3}{8}$.

Reduce 10 Months, $19\frac{3}{8}$ Days, to the Fraction of a Year.

Answ. $\frac{7}{8}$.

ADDITION OF VULGAR FRACTIONS.

Rule. Reduce the given Fractions to a common Denominator; then add all the Numerators together; under which place the common Denominator.

Examples.

Add $\frac{2}{5}$ and $\frac{5}{7}$ together.

$$2 \times 7 = 14$$
$$5 \times 5 = 25$$
$$\overline{39}$$
$$5 \times 7 = 35$$

35)39(1
35
——
4/35

Ans. $1\frac{4}{35}$.

Add

Add $\frac{3}{4}$, $\frac{5}{9}$, and $\frac{2}{7}$, together. *Answ.* $1\frac{149}{252}$.
Add $\frac{1}{3}$, $3\frac{6}{8}$, and $\frac{2}{7}$, together. *Answ.* $4\frac{62}{168}$.
Add $\frac{1}{2}$ of $\frac{9}{11}$, $4\frac{2}{3}$, and $\frac{7}{9}$, together. *Answ.* $5\frac{169}{198}$.

2. When the Fractions are of several Denominations, reduce them to their proper Quantities, and add as before.

Add $\frac{2}{5}$ of a Pound to $\frac{5}{9}$ of a Shilling. *Answ.* 8s. $6\frac{2}{3}$d.
Add $\frac{3}{8}$ of a Pound Avoirdupoise to $\frac{9}{11}$ of an Ounce.
Answ. 6 oz. $13\frac{1}{11}$ drms.

SUBTRACTION of VULGAR FRACTIONS.

RULE. Reduce the given Fractions to a common Denominator; then subtract the less Numerator from the greater, and place the Remainder over the common Denominator.

EXAMPLES.

From $\frac{1}{2}$ take $\frac{2}{7}$.

$$7 \times 1 = 7$$
$$2 \times 2 = 4$$
$$\frac{3}{14} \quad \textit{Answ.}$$
$$2 \times 7 = 14$$

From $\frac{5}{7}$ take $\frac{1}{2}$ of $\frac{5}{9}$. *Answ.* $\frac{55}{126}$.
From $9\frac{5}{8}$ take $\frac{4}{7}$ of 9. *Answ.* $4\frac{27}{56}$.

When the Fractions are of several Denominations, reduce them to their proper Quantities, and subtract as before.

From $\frac{3}{7}$ of a Pound subtract $\frac{5}{9}$ of a Shilling. *An.* $8\frac{1}{63}$ s.
From $\frac{4}{7}$ of a Ton take $\frac{9}{11}$ of a Pound. *Answ.* 11 cwt. 1 qr. 19 lb. $2\frac{10}{11}$ oz.

MULTIPLICATION of VULGAR FRACTIONS.

RULE. The continual Product of all the Numerators is the Numerator sought, and the continual Product of all the Denominators is the Denominator sought.

EXAMPLES.

Multiply $\frac{3}{4}$ by $\frac{2}{7} = \frac{6}{28}$. *Answ.* $\frac{6}{28}$.
Multiply $55\frac{4}{6}$ by $32\frac{5}{8}$. *Answ.* $1816\frac{1}{8}$.
Multiply $30\frac{4}{7}$ by $\frac{3}{4}$ of 9. *Answ.* $69\frac{3}{28}$.

DIVISION OF VULGAR FRACTIONS.

RULE. If the Divisor be more than the Dividend invert your Divisor, and then the Product of the Divisor and Dividend is the Quotient sought; but, if the Divisor be less than the Dividend, bring them to a common Denominator, and then divide.

EXAMPLES.

Divide $\frac{3}{4}$ by $\frac{4}{6}$.

$$\frac{3 \times 6}{4 \times 6} = \frac{18}{24};\quad \frac{4 \times 4}{4 \times 6} = \frac{16}{24};\quad \text{then } \frac{18}{24} \div \frac{16}{24} = 1\frac{2}{24}.$$

Divide $\frac{4}{6}$ by $\frac{3}{4}$. $\frac{4}{6} \times \frac{4}{3} = \frac{16}{18}$. *Answ.* $\frac{16}{18}$.
Divide $275\frac{5}{8}$ by $\frac{1}{7}$ of $\frac{4}{8}$ of 19. *Answ.* $203\frac{7}{76}$.
Divide 32 by 89. *Answ.* $\frac{32}{89}$.

RULE OF THREE IN VULGAR FRACTIONS.

RULE. Multiply the Numerator of the first Fraction by the Denominator of the second and third for a new Denominator, and multiply the Denominator of the first Fraction by the Numerator of the second and third for a new Numerator; which, reduced to its proper Quantity, will be the Answer.

EXAMPLES.

If $\frac{2}{7}$ of a Gallon cost $\frac{5}{9}$ of a Pound, what will $\frac{9}{4}$ of a Gallon cost? *Answ.* $2 \times 9 = 18 \times 4 = 72$ New Divisor.
$7 \times 5 = 35 \times 9 = 315$ 72)315(£ $4\frac{27}{72}$
288
27
72

$$\frac{2}{7} \times \frac{5}{9} — \frac{9}{4}$$

If

If $\frac{1}{2}$ lb. coſt $\frac{1}{2}$ of a Shilling, what will $\frac{1}{4}$ lb. coſt? *Anſw.* 3d.

If $\frac{3}{4}$ of a Yard coſt 7s. 9d. what will 1 Yard coſt? *Anſw.* 10s. 4d.

If $\frac{5}{8}$ of a Gallon coſt 10s. what will 1 Gallon coſt? *Anſw.* 16s.

If 1 Yard of Cloth coſt $17\frac{5}{9}$s. what will 2 Pieces coſt, each containing $27\frac{5}{8}$ Yards? *Anſw.* £ 45 $1\frac{6}{80}$.

If $1\frac{1}{2}$ Ounce of Gold is equal to 5 l. what is the Value of $9\frac{5}{37}$ oz.? *Anſw.* £ 31 10 $3\frac{1}{2}$ $\frac{18}{37}$.

If $5\frac{4}{7}$ Hundred Weight of Sugar coſt $11\frac{5}{12}$ l. what is the Value of $1\frac{3}{7}$ lb.? *Anſw.* £ 2 18 $6\frac{1}{2}$ $\frac{1420}{1638}$.

If $\frac{3}{8}$ of a Yard coſt $\frac{3}{7}$ of a Pound, what will $\frac{4}{5}$ of an Ell coſt at the ſame Rate? *Anſw.* 17s. $10\frac{3}{4}$ $\frac{98}{672}$ d.

What is the Value of $120\frac{3}{5}$ Buſhels of Wheat, at 5s. $7\frac{2}{7}$ per Buſhel. *Anſw.* £ 33 16 $2\frac{1}{2}$ [illegible].

RULE OF THREE INVERSE IN VULGAR FRACTIONS.

Examples.

If 20 Men build a Wall in $20\frac{1}{6}$ Days, how many Men can do the ſame in $196\frac{4}{7}$ Days? *Anſ.* $2\frac{107}{2067}$ Men.

What Quantity of Cloth of $\frac{5}{8}$ of a Yard wide is equal to $7\frac{3}{7}$ Yards of Cloth $\frac{1}{2}$ a Yard wide? *Anſ.* $5\frac{33}{35}$ Yards.

If $7\frac{5}{7}$ s. will pay for the Carriage of a Cwt. 120 Miles, how far may $7\frac{4}{5}$ cwt. be carried for the ſame Money? *Anſw.* $15\frac{15}{39}$ Miles.

DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

Examples.

If £ 100 in 12 Months gain £ 6 Intereſt, what Principal will gain £ $3\frac{3}{8}$ in 9 Months? *Anſw.* £ 150.

If

If a Carrier receives £ $2\frac{1}{10}$ for the Carriage of 3 cwt. 150 Miles, how much ought he to receive for the Carriage of $15\frac{3}{8}$ cwt. 100 Miles. *Answ.* £ $7\frac{21}{80}$.

If 9 Students spend £ $10\frac{3}{8}$ in 18 Days, how much will 40 Students spend in 30 Days? *Ans.* £ 79 16 $9\frac{262}{1458}$.

DECIMAL FRACTIONS.

A Decimal Fraction is a Fraction whose Denominator is always 10, or some Power of 10, as 10, or 100, or 1000, &c. and the Number of 0s is always equal to the Number of Places in the Numerator: Hence, the Numerator being known, the Denominator is also known, and therefore never set down.

	Dec.		Vulg.		Dec.		Vulg.		Dec.		Vulg.
Viz.	,25	=	$\frac{25}{100}$,	and	,250	=	$\frac{25}{100}$,	and	,025	=	$\frac{25}{1000}$.

Decimals are of 3 Sorts; *viz.*

A Finite Decimal, as ,25 = $\frac{1}{4}$.

A Recurring Decimal, as 2,75222.

A Compound Recurring Decimal, as 52,275275275.

Note. In all circulating Numbers dash the first Figure thus, ,1666.

ADDITION OF DECIMALS.

RULE. Add as in whole Numbers; only observe that the Commas, or Decimal Points, should be under one another.

EXAMPLES.

Add 75,47 + 3,709 + 75,1072 + 10,74 + 7,10.
Answ. 172,1262.

Add 1,05 + 75,962 + 10,7486 + 13,72.

Add 70,4 + 10,796 + 1,5 + 720,4 + 75,7296.

Add 170,250 + 7,5 + 2,16 + 759,10.

Add 7,5 + 9,3 + ,072 + 10,64 + ,00079.

SUB-

SUBTRACTION OF DECIMALS.

RULE. Subtract as in whole Numbers, observing the Rule of Addition for the Decimal Points.

EXAMPLES.

From ,2758 take ,174. From 7,50 take 1,7965.
From 10,75 take 1,720. From 2,075 take ,0759.

MULTIPLICATION OF DECIMALS.

RULE. Multiply as in whole Numbers; then cut off as many Places for Decimals as are in both Factors.

Note. If there should not be so many Places in the Product as in the Factors, supply the Defect with Ciphers to the Left-Hand.

EXAMPLES.

Multiply 3,70 by ,769. *Answ.*
Multiply 758,7 by 17,049. Mult. 75,047 by 10,769.
Multiply 10,765 by ,37. Multiply ,197 by ,70049.

DIVISION OF DECIMALS.

RULE. Cut off as many Places for Decimals in the Quotient as the Dividend has Decimals more than the Divisor.

Note. If there should not be so many Places in the Quotient, supply the Defect with Ciphers to the Decimal Point.

EXAMPLES.

Divide 749,052 by 3,072. *Answ.* 243.
Divide ,7204 by 1475. Divide 17,05 by 769,8.
Divide ,7100 by ,9764. Divide 1750,6 by ,0075.

RE-

REDUCTION OF DECIMALS.

To reduce a Vulgar Fraction to a Decimal.

RULE. Add Ciphers to the Numerator, and divide by the Denominator; the Quotient is the Answer.

EXAMPLES.

Reduce $\frac{1}{4}$ to a Decimal. *Answ.* ,25.
Reduce $\frac{5}{9}$ to a Decimal. *Answ.* ,55+.
Reduce $\frac{7}{11}$ to a Decimal. *Answ.* ,636+.
Reduce $\frac{5}{17}$ to a Decimal. *Answ.* ,29+.
Reduce $\frac{3}{8}$ to a Decimal. *Answ.* ,375.
Reduce $\frac{5}{26}$ to a Decimal. *Answ.* ,1923076+.
Reduce 14s. 2½d. to the Decimal of a Pound.

```
  14s.  2½d.
  12
  ---
  170
    4
  ---
960)6830(,71145833+
    6720
    ----
     1100
      960
     ----
     1400
      960
     ----
     4400
     3840
     ----
      5600
      4800
      ----
      8000
      7680
      ----
       3200
       2880
       ----
       3200
       2880
       ----
```

```
    4)3,00
   ---------
  12)2,750000
   ---------
  20)14,2291666
   ---------
    ,71145833+ Ans.
```

Third.
```
 2)14      2½
  ---       4
   7⅓     ---
           11
```

Reduce

Reduce 5s. to the Decimal of a Pound. *Ans.* ,25.
Reduce 9s. 4d. to the Decimal of a Pound. *Ans.* ,466+.
Reduce 17s. 4½d. to the Decimal of a Pound. *An.* ,86875.
Reduce 12 Grains to the Decimal of a lb. Troy.
Answ. ,002083+.
Reduce 14 Drachms to the Decimal of a Pound Avoirdupoise. *Answ.* ,0545625.
Reduce 3 Furl. to the Decimal of a League. *Ans.* ,125.
Reduce 12 gall. to the Decimal of a Barrel. *Ans.* ,33+.
Reduce 3 qrs. 14 lb. 7 oz. 12 dr. to the Decimal of a Cwt. *Answ.* ,879325.

To find the Value of any Decimal in the known Parts of an Integer.

RULE. Multiply the Decimal given by the Number of Parts of the next inferior Denomination, cutting off the Decimals from the Product; then multiply the Remainder by the next inferior Denomination; thus proceeding till you have brought it into the least known Part of an Integer.

EXAMPLES.

What is the Value of ,75986 of a Pound?

```
      20          Ans. 15s. 2¾,46+
 ---------
  15,19720
        12
 ---------
   2,36640
         4
 ---------
   1,46560
 ---------
```

What is the Value of ,25 of a Pound? *Ans.* 5s.
What is the Value of ,47 of a Pound? *Ans.* 9s. 4d.
What is the Value of ,86875 of a Pound? *Ans.* 17s. 4½d.
What is the Value of ,002084 of a lb. Troy? *Ans.* 12 grs.
What is the Value of ,0545625 of a lb. Avoird.? *Ans.* 14 dr.
What is the Value of ,125 of a League? *Ans.* 3 Furlongs.
What is the Value of ,34 of a Barrel? *Ans.* 12 Gallons.
What is the Value of ,879325 of a Cwt.?
Ans. 3 qrs. 14 lb. 7 oz. 12 dr.

DECIMAL

Decimal Tables *of* Coin, Weight, *and* Measure.

TABLE I.

English Coin.

1l. the Integer.

Sh.	*D.*	*Sh.*	*D.*
19	,95	9	,45
18	,9	8	,4
17	,85	7	,35
16	,8	6	,3
15	,75	5	,25
14	,7	4	,2
13	,65	3	,15
12	,6	2	,1
11	,55	1	,05
10	,5		

Pence.	*Decimals.*
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

Farth.	*Decimals.*
3	,003125
2	,0020833
1	,0010416

TABLE II.

English Coin,

1s. the Integer.

Long Measure,

1 Foot the Integer.

Pence and Inches.	*Decimals.*
6	,5
5	,416666
4	,333333
3	,25
2	,166666
1	,083333

Farth.	*Decimals.*
3	,0625
2	,041666
1	,020833

TABLE III.

Troy-Weight,

1lb. the Integer.

Ounces the same as Pence in the last Table.

Penny-weights.	*Decimals.*
10	,041666
9	,0375
8	,033333
7	,029166
6	,025
5	,020833
4	,016666
3	,0125
2	,00833
1	,004166

Grains.	*Decimals.*
12	,002083
11	,001910
10	,001736
9	,001562
8	,001389
7	,001215
6	,001042
5	,000868
4	,000694
3	,000521
2	,000347
1	,000173

1 oz. the Integer.

Pennyweights the same as Shillings in Table I.

12	,025
11	,022916
10	,020833
9	,01875
8	,016666
7	,014583
6	,0125
5	,010416
4	,008333
3	,00625
2	,004166
1	,002083

TABLE IV.

Avoir. Weight,

112lb. the Integ.

DECIMAL TABLES *of* COIN, WEIGHT, *and* MEASURE.

Qrs.	*Decimals.*
3	,75
2	,5
1	,25

Pounds.	*Decimals.*
14	,125
13	,116071
12	,107143
11	,098214
10	,089286
9	,080357
8	,071428
7	,0625
6	,053571
5	,044643
4	,035714
3	,026786
2	,017857
1	,008928

Ounces.	*Decimals.*
8	,004464
7	,003906
6	,003348
5	,002790
4	,002232
3	,001674
2	,001116
1	,000558

¼ *Oz.*	*Decimals.*
3	,000418
2	,000279
1	,000139

TABLE V.

AVOIR. WEIGHT.

1lb. the Integer.

Ounces.	*Decimals.*
8	,5
7	,4375
6	,375
5	,3125
4	,25
3	,1875
2	,125
1	,0625

Drams.	*Decimals.*
8	,03125
7	,027343
6	,023437
5	,019531
4	,015625
3	,011718
2	,007812
1	,003906

TABLE VI.

LIQUID MEAS.

1 Tun the Integer.

Gall.	*Decimals.*
100	,396825
90	,357141
80	,317460
70	,27
60	,238095
50	,198412
40	,158730
30	,119047
20	,079365
10	,039682
9	,035714
8	,031746
7	,027
6	,023809
5	,019841
4	,015873
3	,011904
2	,007936
1	,003968

Pints.	*Decimals.*
4	,001984
3	,001488
2	,000992
1	,000496

A Hogshead of Wine the Integ.

Gall.	*Decimals.*
30	,476190
20	,317460
10	,158730
9	,142857
8	,126984
7	,111111
6	,095238
5	,079365
4	,063492
3	,047619
2	,031746
1	,015873

DECIMAL TABLES *of* COIN, WEIGHT, *and* MEASURE.

Pints.	*Decimals.*
3	,005952
2	,003968
1	,001984

TABLE VII.

MEASURE,

LIQUID, 1 Gallon the Integer.

DRY, 1 Quarter the Integer.

Pints.	*Dec.*	*Bush.*
4	,5	4
3	,375	3
2	,25	2
1	,125	1

Q.Pts.	*Dec.*	*Peck.*
3	,09375	3
2	,0625	2
1	,03125	1

Decimals.	*Q.Pks.*
,0234375	3
,015625	2
,0078125	1

Decimals.	*Pints.*
,005859	3
,003960	2
,001953	1

TABLE VIII.

CLOTH MEAS.

1 Yard the Integ.

Quarters the same as in Table IV.

Nails.	*Decimals.*
2	,125
1	,0625

TABLE IX.

LONG MEASURE

1 Mile the Integ

Yrds.	*Decimals.*
1000	,568182
900	,511364
800	,454545
700	,397727
600	,340909
500	,284091
400	,227272
300	,170454
200	,113636
100	,056818
90	,051136
80	,045454
70	,039773
60	,034091
50	,028409
40	,022727
30	,017045
20	,011364
10	,005682
9	,005114
8	,004545
7	,003977
6	,003409
5	,002841
4	,002273
3	,001704
2	,001136
1	,000568

Feet.	*Decimals.*
2	,0003787
1	,0001894

Inch.	*Decimals.*
6	,0000947
3	,0000474
1	,0000158

TABLE X.

TIME.

1 Year the Integ.

Months the same as Pence in Tab. II.

Days.	*Decimals.*
300	,821918
200	,547945
100	,273973
90	,246575
80	,219178
70	,191781
60	,164383

Decimal Tables *of* Coin, Weight, *and* Measure.

50	,136986
40	,109589
30	,082192
20	,054794
10	,027397
9	,024657
8	,021918
7	,019178
6	,016438
5	,013698
4	,010959
3	,008219
2	,005479
1	,002739

1 Day the Integer.

Hours.	*Decimals.*
12	,5
11	,458333
10	,416666
9	,375
8	,333333
7	,291666
6	,25
5	,208333
4	,166666
3	,125
2	,083333
1	,041666

Min.	*Decimals.*
30	,020833
20	,013888
10	,006944
9	,00625
8	,005555
7	,004861
6	,004166
5	,003472
4	,002777
3	,002083
2	,001388
1	,000694

TABLE XI.

Lead Weight.

1 Fother the Integer.

Hund.	*Decimals.*
10	,512820
9	,461538
8	,410256
7	,358974
6	,307692
5	,256410
4	,205128
3	,153846
2	,102564
1	,051282

Qrs.	*Decimals.*
2	,025641
1	,012820

Pounds.	*Decimals.*
14	,0064102
13	,0059523
12	,0054945
11	,0050366
10	,0045787
9	,0041208
8	,0036630
7	,0032051
6	,0027472
5	,0022893
4	,0018315
3	,0013736
2	,0009157
1	,0004578

The Rule of Three in Decimals.

Examples.

If 15½ Yards cost £ 1 17 0, what will 50 Yards come to at the same Rate?

As 15,5 : 1,85 :: 50: *Ans.* £ 5,96+.

What is the Value of 82¾ Yards of Painting, at 10d. *per* Yard? *Answ.* £ 3 8 11¼.

Bought 12,3125 cwt. of Sugar, at 7½ d. *per* Pound, what is the Value of the Whole? *Answ.* £ 91,196875.

If I lend my Friend £ 68 for ⅝ of a Year, how much ought he to lend me for 5/12 of a Year, to requite my Kindness? *Answ.* £ 102.

If 1 lb. of Tobacco cost 15 d. what cost 3 Hhds. weighing each 7,875 cwt.? *Ans.* £ 11 0 6

What will be the Pay of 40 Men, at £ 7 12 6¾ *per* Man? *Answ.* £ 305 2 6.

What is the Value of 16 oz. 3 dwts. 7 grs. of Gold, at £ 3 17 0 *per* Ounce? *Answ.* £ 62,23204+.

If 1 oz. of Silver cost 5,75 s. what is the Price of a Silver Tea-board weighing 20 lb. 14 oz. 17 dwts. 5 gr.? *Answ.* £ 44,4.

If 2 cwt. of Currants cost £ 4 7 8, what is the Value of 27 cwt. 3 qrs. 19 lb. *Answ.* £ 66,14267.

If 50 lb. 7 oz. of Coffee were bought for £ 12 10 8, what is the Value of 4½ lb.? *Answ.* £ 1,1+.

SIMPLE INTEREST IN DECIMALS.

There are five Letters to be observed in Simple Interest; *viz.*

P the Principal.
T the Time.
R the Ratio or Rate *per Cent.*
I the Interest.
A the Amount.

A TABLE *of* RATIOS.

3	,03	5½	,055	8	,08
3½	,035	6	,06	8½	,085
4	,04	6½	,065	9	,09
4½	,045	7	,07	9½	,095
5	,05	7½	,075	10	,1

Note.

Note. The Ratio is the Simple Interest of £ 1 for one Year, at the Rate *per Cent.* proposed, and is found thus.

£ £ £
As 100 : 3 :: 1 : ,03. As 100 : ,35 :: 1 : ,035.

When the Principal, Time, and Rate per Cent. are given, to find the Interest.

Rule. Multiply the Principal, Time, and Rate, together, and it will give the Interest required.

Note. The Proposition and Rule are better expressed thus:

When P, T, *and* R, *are given, to find* I.

Rule. *prt* = I.

Note. When two or more Letters are put together like a Word, they are to be multiplied one into the other.

Examples.

What is the Interest of £ 100, for 3 Years, at 5 *per Cent.*?

£ 100 × ,05 × 3 = 15,00. *Answ.* £ 15.

What is the Interest of £ 273 17, at 4 *per Cent. per Annum*, for 6 Years? *Answ.* £ 65 14 5¼ ,04.

When the Interest is for any Number of Years only.

Rule. Multiply the Interest of £ 1, for 1 Day, at the given Rate, by the Principal and Number of Days, and it will give the Answer.

Table *of* Interest *of* £ 1 *for* one Day.

Per Cent.	*Decimals.*	*Per Cent.*	*Decimals.*
3	,00008219178	6½	,00017808219
3½	,00009589041	7	,00019178082
4	,00010958904	7½	,00020547945
4½	,00012328767	8	,00021917808
5	,00013698630	8½	,00023287671
5½	,00015068493	9	,00024657534
6	,00016438356	9½	,00026027397

Note. The above Table is found thus.

As 365 : ,03 :: 1 : ,00008219178.

And, As 365 : ,035 :: 1 : ,00009589041.

EXAMPLES.

What is the Interest of £ 350 for 120 Days, at 4 *per Cent. per Annum?*

,00010958904 × 350 × 120 = *Answ.* £ 4,60273968.

What is the Interest of £ 281,5, at 6 *per Cent. per Annum*, for 126 Days? *Answ.* £ 5 16 7¼

2. *When* P, R, T, *are given, to find* A.

RULE. $prt + p = A$.

EXAMPLES.

What will £ 559 4 amount to in 7 Years, at 4½ *per Cent. per Annum?*

559,2 × ,045 × 7 + 559,2 = £ 735,348.

What will £ 641 14 amount to, in 5 Years, at 3½ *per Cent. per Annum?* *Answ.* £ 753 19 11 1,6 qr.

When there is any odd Time given with the whole Years, reduce the odd Time into Days, and work with the decimal Parts of a Year, which are equal to those Days.

What will £ 463 6 amount to, in 5½ Years, at 4 *per Cent. per Annum?* *Answ.* £ 565 4 6 ,96.

3. *When* A, R, T, *are given, to find* P.

RULE. $\frac{a}{rt+1} = P$.

EXAMPLES.

What Principal, being put to Interest, will amount to £ 735 6 11½ ,08 qr. in 7 Years, at 4½ *per Cent.*?

,045 × 7 + 1 = 1,315; then 735,348 ÷ 1,315 = *Answ.* £ 559,2.

What Principal, being put to Interest, will amount to £ 753 19 11 1,6 in 5 Years, at 3½ *per Cent. per Annum?* *Answ.* £ 641 14 0.

4. *When* A, P, T, *are given, to find* R.

RULE. $\frac{a-p}{pt} = R$.

EXAMPLES.

EXAMPLES.

At what Rate *per Cent.* will £ 559 4 amount to £ 735,348 in 7 Years?

£ 735,348 — 559,2 = 176,148; 559,2 × 7 = 3914,4; then 176,148 ÷ 3914,4 = ,045, or $4\frac{1}{2}$ *per Cent.*

At what Rate *per Cent.* will £ 641 14 0 amount to £ 753 19 11 1,6 in 5 Years? *Ans.* $3\frac{1}{2}$ *per Cent.*

5. *When* A, P, R, *are given, to find* T.

RULE. $\frac{a-p}{pr} = T.$

EXAMPLES.

In what Time will £ 559,4 amount to £ 735 6 $11\frac{1}{2}$,08, at $4\frac{1}{2}$ *per Cent.*? *Answ.* 7 Years.

735,348 — 559,2 = 176,148; 559,2 × ,045 = 25,1640; then 176,148 ÷ 25,1640 = 7 Years, *Answ.*

In what Time will £ 641,14 amount to £ 753 19 s. 11 d. 1,6, at $3\frac{1}{2}$ *per Cent.*? *Ans.* 5 Years.

ANNUITIES *or* PENSIONS, &c. IN ARREARS.

Annuities or Pensions, &c. are said to be in Arrears when they are payable or due either yearly, half-yearly, or quarterly, and are unpaid for any Number of Payments.

Note. U represents the Annuity or yearly Rent. T, R, A, as before.

1. *When* U, R, T, *are given, to find* A.

RULE. $\frac{ttu-tu}{2} \times r + tu = A.$

EXAMPLES.

If a Salary of £ 300 be forborne 5 Years, at 5 *per Cent.* what would it amount to? *Ans.* £ 1650.

5 × 5 × 300 — 5 × 300 = 6000; then $\frac{6000}{2}$ × ,05 + 5 × 300 = £ 1650.

If

If £500 yearly Pension be forborne 7 Years, what will it amount to in that Time, at 6 *per Cent.*? *Answ.* £4130.

There is a House let on Lease for $5\frac{1}{2}$ Years, at £120, *per Annum*, what will be the Amount of it for the whole Time, at $4\frac{1}{2}$ *per Cent.*? *Answ.* £726 16 6.

Note. When Annuities, &c. are to be paid half-yearly or quarterly, then, for half-yearly Payments, take Half the Ratio, Half the Annuity, &c. and twice the Number of Years; and, for quarterly Payments, take a fourth Part of the Ratio, a fourth Part of the Annuity, &c. and four-times the Number of Years, and work as before.

Examples.

If a Salary of £300, payable every Half-Year, remains unpaid for 5 Years, what would it amount to in that Time at 5 *per Cent.*? *Answ.* £1668 15 0.

If a Salary of £300, payable every Quarter, was left unpaid for 5 Years, what would it amount to at 5 *per Cent.*? *Answ.* £1678 2 6.

Note. By comparing these Examples, it appears that half-yearly Payments are better than yearly, and quarterly better than half-yearly.

2. *When* A, R, T, *are given, to find* U.

Rule. $\dfrac{2a}{ttr - tr + 2t} = U.$

Examples.

If a Salary amounted to £1650 in 5 Years, at 5 *per Cent.* what was the Salary? *Answ.* £300.

$1650 \times 2 = 3300$; $5 \times 5 \times ,05 - 5 \times ,05 + 5 \times 2 = 11$; then $3300 \div 11 = £300$, *Answ.*

If a Salary amounted to £726 16 6, at $4\frac{1}{2}$ *per Cent.* for $5\frac{1}{2}$ Years, what is the yearly Salary? *Answ.* £120.

Note. When the Payments are half-yearly, then take 4a, Half of the Ratio, and twice the Number of Years; and, if quarterly, then take 8a, one Fourth of the Ratio, and four-times the Number of Years, and proceed as before.

If the Amount of a Salary, payable half-yearly, for 5 Years, and at 5 *per Cent.* be £ 1668 15 0, what is the Salary? *Answ.* £ 300.

If the Amount of an Annuity, payable quarterly, be £ 1678 2 6, for 5 Years, at 5 *per Cent.* what is the Annuity? *Answ.* £ 300.

3. *When* U, A, T, *are given, to find* R.

RULE. $\frac{2a - 2ut}{utt - ut} = R.$

EXAMPLES.

If a Salary of £ 300 *per Annum* amount to £ 1650 in 5 Years, what is the Rate *per Cent.*? *Ans.* 5 *per Cent.*

$1650 \times 2 - 300 \times 5 \times 2 = 300$; then $\frac{300}{300 \times 5 \times 5 - 300 \times 5}$

$= ,05 = 5$ *per Cent.*

If a House be let upon Lease for $5\frac{1}{2}$ Years, at £ 120 *per Annum*, and the Amount of that Time is £ 726 16 6, what is the Rate *per Cent.*? *Answ.* $4\frac{1}{2}$.

Note. When the Payments are half-yearly, take $4a - 4ut$ for a Dividend, work with Half the Annuity, and double the Number of Years for a Divisor; if quarterly, take $8a - 8ut$, and work with a Fourth of the Annuity, and four-times the Number of Years.

EXAMPLES.

If a Salary of £ 300 *per Annum*, payable half-yearly, amounts to £ 1668 15 0, in 5 Years, what is the Rate *per Cent.*? *Answ.* 5 *per Cent.*

If a Salary of £ 300 *per Annum*, payable quarterly, amounts to £ 1678 2 6 in 5 years, what is the Rate *per Cent.*? *Answ.* 5 *per Cent.*

4. *When*

4. *When* U, A, R, *are given, to find* T.

RULE. $\frac{2}{r} - 1 = x$; then $\sqrt{\frac{2a}{ur} + \frac{xx}{4}} - \frac{x}{2} = T$.

EXAMPLES.

In what Time will a Salary of £ 300 *per Annum* amount to £ 1650, at 5 *per Cent?* *Answ.* 5 Years.

$$\frac{2}{,05} - 1 = 39 \quad \frac{1650 \times 2}{300 \times ,05} = 440 \quad \frac{39 \times 39}{4} = 380{,}25.$$

$$\sqrt{220 + 380{,}25} = 24{,}5 - \frac{39}{2} = 5 \text{ Years.}$$

If a House is let on Lease for a certain Time for £ 120 *per Annum*, and the Amount is £ 726 16 6, at $4\frac{1}{2}$ *per Cent.* what Time was it let for? *Answ.* $5\frac{1}{2}$ Years.

Note. If the Payments are half-yearly take Half the Ratio and Half the Annuity; if quarterly, one-fourth of the Ratio and one-fourth of the Annuity, and T will be equal to those half-yearly and quarterly Payments.

If an Annuity of £ 300 *per Annum*, payable half-yearly, amounts to £ 1668 15 0, at 5 *per Cent.* what Time was the Payment forborne? *Answ.* 5 Years.

If an Annuity of £ 300 *per Annum*, payable quarterly, amounts to £ 1678 2 6, at 5 *per Cent.* what was the Time of Forbearance? *Answ.* 5 Years.

PRESENT WORTH *of* ANNUITIES.

Note. P represents the present Worth, U, T, R, as before.

1. *When* U, T, R, *are given, to find* P.

RULE. $\frac{ttr - tr + 2t}{2tr + 2} \times u = P.$

EXAMPLES.

What is the present Worth of £ 300 *per Annum*, to continue 5 Years, at 5 *per Cent.?* *Answ.* £ 1320.

5

$\overline{5\times5\times,05} - \overline{5\times,05} + \overline{5\times2} = 11$. $5\times.05\times2 + 2 = 2,5$: Then $11 \div 2,5 \times 300 = £1320$.

What is the yearly Rent of a House of £ 120, to continue $5\frac{1}{2}$ Years, worth in ready Money at $4\frac{1}{2}$ *per Cent.*?

Answ. £ 582 12 6

Note. For half-yearly and quarterly Payments observe the same Thing as in the first Rule of Annuities in Arrears.

What is the present Worth of £ 300, payable half-yearly, for 5 Years, at 5 *per Cent.*? £ 1335 0 0

What is the present Worth of £ 300, payable quarterly, for 5 Years, at 5 *per Cent.*? *Answ.* £ 1342 10 0

2. *When* P, T, R, *are given, to find* U.

RULE. $\frac{tr+1}{tr - tr + 2t} \times 2p = U.$

EXAMPLES.

If the present Worth of a Salary be £ 1320, to continue 5 Years, at 5 *per Cent.* what was the Salary?

Answ. £ 300 0 0

$5\times,05 + 1 = 1,25$. $5\times5\times,05 - 5\times,05 + 10 = 11$. Then $\frac{1,25}{11}\times1320\times2 = 300$.

There is a House, let upon Lease for $5\frac{1}{2}$ Years, I desire to know the yearly Rent when the present Worth, at $4\frac{1}{2}$ *per Cent.* is £ 582 12 6? *Answ.* £ 120 0 0

Note. When the Payments are half-yearly take Half the Ratio, twice the Number of Years, and multiply by $4p$; and, when quarterly, take one-fourth of the Ratio, four Times the Number of Years, and multiply by $8p$.

There is an Annuity, payable half-yearly for 5 Years to come, what is the yearly Rent when the present Worth, at 5 *per Cent.* is £ 1335 0 0? *Answ.* £ 300 0 0

There is an Annuity, payable quarterly, for 5 Years to come, I desire to know the yearly Income when the present Worth, at 5 *per Cent.* is £ 1342 10 0?

Answ. £ 300 0 0

3. *When*

3. *When* U, P, T, *are given, to find* R.

Rule. $\frac{\overline{ut-p}\times 2}{2pt+ut-utt}=R.$

Examples.

At what Rate *per Cent.* will an Annuity of £ 300 *per Annum*, to continue 5 Years, produce the present Worth of £ 1320? *Answ.* £ 5 *per Cent.*

$300\times 5-1320\times 2=360$; $2\times 1320\times 5+300\times 5-300\times 5\times 5=7200$: Then $360\div 7300=,05=5$ *per Cent.*

If a yearly Rent of £ 120 *per Annum*, to continue $5\frac{1}{2}$ Years, produce £ 582 12 6 for the present Worth, what is the Rate *per Cent.*? *Answ.* £ $4\frac{1}{2}$ *per Cent.*

For half-yearly Payments take Half the Annuity, &c. and twice the Number of Years, the Quotient will be the Ratio of Half the Rate *per Cent.* &c.

For quarterly Payments take a fourth Part of the Annuity, &c. and four Times the Number of Years, the Quotient will be the Ratio of a fourth Part of the Rate *per Cent.*

An Annuity of £ 300 *per Annum*, payable half-yearly, having 5 Years to come, is sold for £ 1335; what is the Rate *per Cent.*? *Answ.* £ 5 *per Cent.*

If an Annuity of £ 300 *per Annum*, payable quarterly, having 5 Years to come, is sold for £ 1342 10 0, what is the Rate *per Cent.*? *Answ.* £ 5 *per Cent.*

4. *When* U, P, R, *are given, to find* T.

Rule. $\frac{2}{r}-\frac{2p}{u}-1=x$: Then $\sqrt{\frac{2p}{ur}+\frac{x^2}{4}}-\frac{x}{2}=T.$

Examples.

If an Annuity of £ 300 *per Annum* produce £ 1320 for the present Worth, at 5 *per Cent.* what is the Time of its Continuance? *Answ.* 5 Years.

2

$$\frac{2}{,05} - \frac{1320 \times 2}{300} - 1 = 30{,}2 \quad \frac{1320 \times 2}{300 \times ,05} = 176.$$

$$\frac{30{,}2 \times 30{,}2}{4} = 228{,}01 \text{: Then } \sqrt{228{,}01 + 176} = 20{,}1;$$

$$20{,}1 - \frac{30{,}2}{2} = 5 \text{ Years.}$$

For what Time may a Salary of £ 120 be purchased for £ 582 12 6, at $4\frac{1}{2}$ *per Cent.*? *Answ.* $5\frac{1}{2}$ Years.

Note. When the Payments are half-yearly, then U will be equal to the Half Annuity, &c. R Half the Ratio, and T the Number of Payments; and, when the Payments are quarterly, U will be equal to a fourth Part of the Annuity, &c. R the fourth of the Ratio, and T the Number of Payments.

If an Annuity of £ 300 *per Annum*, payable half-yearly, be sold for £ 1335, at 5 *per Cent.* I desire to know the Number of Payments and the Time to come?

Answ. 10 Payments: 5 Years.

An Annuity of £ 300 *per Annum*, payable quarterly, is sold for £ 1342 10 0, at 5 *per Cent.* what is the Number of Payments and the Time to come?

Answ. 20 Payments: 5 Years.

ANNUITIES, &c. *taken in* REVERSION.

1. *To find the present Worth of an Annuity, &c. taken in Reversion.*

RULE. Find the present Worth of the yearly Sum at the given Rate and for the Time of its Continuance.

$$\text{Thus } \frac{ttr - tr + 2t}{2tr + 2} \times u = P.$$

2. Change P into A, and find what Principal being put to Interest will amount to A at the same Rate and for the Time to come before the Annuity, &c. commences:

$$\text{Thus } \frac{a}{tr + 1} = P.$$

EXAMPLES.

What is the present Worth of an Annuity of £ 300 *per Annum*, to continue 5 Years, but not to commence till the End of 4 Years, allowing 5 *per Cent.* to the Purchaser? *Answ.* £ 1100 0 0

$$\overline{5\times5\times,05}-\overline{5\times,05}+\overline{2\times5}=4,4\times300=1320;$$

$$\text{Then } \frac{1320}{4\times,05+1}=£\,1100\ 0\ 0.$$

What is the present Worth of a Lease of £ 100 *per Annum*, to continue four Years, but not to commence till the End of 5 Years, allowing 4 *per Cent.* to the Purchaser? *Answ.* £ 304 11 $11\frac{1}{4}$.

To find the yearly Income of an Annuity, &c. in Reversion.

RULE 1. Find the Amount of the present Worth at the given Rate and for the Time before the Reversion.

Thus $ptr+p=A$.

2. Change A into P, and find what Annuity, being sold, will produce P at the same Rate, and for the Time of its Continuance.

$$\text{Thus } \frac{tr+1}{ttr-tr+2t}\times2p=U.$$

EXAMPLES.

A Person, having an Annuity left him for 5 Years, which did not commence till the End of 4 Years, disposed of it for £ 1100, allowing 5 *per Cent.* to the Buyer, what was the yearly Income? *Answ.* £ 300 0 0

$$\overline{1100\times4\times,05}+1100=1320;$$

$$\frac{5\times,05+1}{\overline{5\times5\times,05}-\overline{5\times,05}+\overline{5\times2}}=,113630\times1320\times2=£\,300\ 0\ 0.$$

There is a Lease of a House taken for 4 Years, but not to commence till the End of 5 Years; the Lessee would sell the same for £ 304 12 0, present Payment, allowing 4 *per Cent.* to the Purchaser, what is the yearly Rent? *Answ.* £ 100 0 0.

REBATE

REBATE or DISCOUNT.

Note. S represents the Sum to be discounted.
P the present Worth.
T the Time.
R the Ratio.

1. *When* S, T, R, *are given, to find* P.

RULE. $\frac{s}{tr+1} = P$.

EXAMPLES.

What is the present Worth of £715 0 0, due 9 Months hence, at 5 *per Cent.*? *Answ.* £689 3 $1\frac{1}{2}$,336.

$$\frac{715}{,75 \times ,05 + 1} = 689,1566.$$

What is the present Worth of £551, due 7 Months hence, at 5 *per Cent.*? *Answ.* £535 7 8,328.

2. *When* P, T, R, *are given, to find* S.

RULE. $ptr + p = S$.

EXAMPLE.

If the present Worth of a Sum of Money, due 9 Months hence, allowing 5 *per Cent.* be £689,1566, what was the Sum first due? *Answ.* £715 0 0.

3. *When* S, P, T, *are given, to find* R.

RULE. $\frac{s-p}{tp} = R$.

EXAMPLES.

At what Rate *per Cent.* will £715, payable 9 Months hence, produce £689,1566 for present Payment? *Answ.* 5 *per Cent.*

$$\frac{715 - 689,1566}{689,1566 \times ,75} = ,05 = 5 \textit{ per Cent.}$$

At what Rate *per Cent.* will £551, payable 7 Months hence, produce £535 7 8,328 for present Payment?

Answ. 5 *per Cent.*

4. *When* S, P, R, *are given, to find* T.

RULE. $\frac{s-p}{rp} = T.$

EXAMPLES.

The present Worth of £715, due for a certain Time to come, is £689 3 1½,336, at 5 *per Cent.* in what Time should the Sum have been paid without any Rebate?

Answ. 9 Months.

$$\frac{715 - 689,1566}{689,1566 \times ,05} = ,75 = 9 \text{ Months.}$$

The present Worth of £551, due some Time hence, is £535 7 8, at 5 *per Cent.* in what Time should the Sum have been paid without any Discount?

Answ. 7 Months.

EQUATION OF PAYMENTS.

To find the equated Time for the Payment of a Sum of Money, due at several Times.

RULE. Find the present Worth of each Payment for its respective Time: Thus $\frac{s}{tr+1} = P.$ Add all the present Worths together: Then $s - p = D$; and $\frac{d}{pr} = E.$

EXAMPLES.

A owes B 200 l. whereof 40 l. is to be paid at 3 Months, 60 l. at 5 Months, and 100 l. at 10 Months; at what Time may the whole Debt be paid together, without Prejudice to either, Rebate being made at 5 *per Cent.*?

$\frac{40}{1,0125} = 39,5061$; $\frac{60}{1,02083} = 58,7+$; $\frac{100}{1,041665}$ $= 96,08+$; then $200 - \overline{39,5061 + 58,7 + 96,08}$ $= \frac{5,7139}{194,2861 \times ,05} = ,58+$; = to about 6 Months, 28 Days.

D owes E 1600 l. whereof 400 l. is to be paid in 3 Months, 400 l. at 4 Months, and 800 l. at 6 Months; but they agreeing to make but one Payment of the whole, at the Rate of 5 *per Cent.* Rebate, what is the true equated Time? *Answ.* 4 Months, 22 Days.

COMPOUND INTEREST.

The Letters used in Compound Interest are,

A the Amount.
P the Principal.
T the Time.
R the Amount of £ 1 for 1 Year, at any given Rate; which is found thus.

As 100 : 105 :: 1 : 1,05.
As 100 : 105,5 :: 1 : 1,055.

A Table *of the* Amount *of* £ 1 *for* 1 Year.

Rates per Cent.	*Amounts of* £ 1.	*Rates per Cent.*	*Amounts of* £ 1.	*Rates per Cent.*	*Amounts of* £ 1.
3	1,03	5½	1,055	8	1,08
3½	1,035	6	1,06	8½	1,085
4	1,04	6½	1,065	9	1,09
4½	1,045	7	1,07	9½	1,095
5	1,05	7½	1,075	10	1,1

A TABLE, *shewing the* AMOUNT *of* £ 1 *for any Number of Years under* 31, *at* 5 *and* 6 *per Cent. per Annum.*

Years.	5 Rates.	6	*Years.*	5 Rates.	6
1	1,05000	1,06000	16	2,18287	2,54035
2	1,10250	1,12360	17	2,29201	2,69277
3	1,15762	1,19101	18	2,40662	2,85434
4	1,21550	1,26247	19	2,52695	3,02559
5	1,27628	1,33822	20	2,65329	3,20713
6	1,34009	1,41852	21	2,78596	3,39956
7	1,40710	1,50363	22	2,92526	3,60353
8	1,47745	1,59384	23	3,07152	3,81975
9	1,55132	1,68948	24	3,22510	4,04893
10	1,62889	1,79084	25	3,38635	4,29187
11	1,71034	1,89829	26	3,55567	4,54938
12	1,79585	2,01219	27	3,73345	4,82234
13	1,88565	2,13292	28	3,92013	5,11168
14	1,97993	2,26090	29	4,11613	5,41838
15	2,07892	2,39655	30	4,32194	5,74349

Note. The above Table is made thus:

As 100 : 105 :: 1 : 1,05, for the first Year.

Then, As 100 : 105 :: 1,05 : 1,1025, second Year.

1. *When* P, T, R, *are given, to find* A.

RULE. $p \times rt = A$.

EXAMPLES.

What will £ 450 amount to in 3 Years Time, at 5 *per Cent. per Annum?* 1,05 × 1,05 × 1,05 = 1,157625; then 1,157625 × 450 = £ 520 18 $7\frac{1}{2}$ *Answ.*

What will £ 400 amount to in 4 Years, at 5 *per Cent. per Annum?* *Answ.* £ 486 4,0508.

2. *When* A, R, T, *are given, to find* P.

RULE. $\frac{a}{rt} = P$.

EXAMPLES.

EXAMPLES.

What Principal, being put to Interest, will amount to £520 18 $7\frac{1}{2}$, in 3 Years, at 5 *per Cent.*? *Anſ.* £450.

$1,05 \times 1,05 \times 1,05 = 1,57625$; then $\frac{520,931250}{1,57625} =$ £450.

What Principal, being put to Intereſt, will amount to £486 4,0508. in 4 Years, at 5 *per Cent.*? *Anſw.* £400.

3. *When* P, A, T, *are given, to find* R.

RULE. $\frac{a}{p} = rt$; which being extracted by the Rule of Extraction, (the Time given ſhewing the Power,) will give the Anſwer.

EXAMPLES.

At what Rate *per Cent.* will £450 amount to £520 18s. $7\frac{1}{2}$d. in 3 Years? *Anſw.* 5 *per Cent.*

$\frac{520,93125}{450} = 1,157625$, the Cube-Root of which is $1,05 = 5$ *per Cent.*

At what Rate *per Cent.* will £400 amount to £486 4,0508. in 4 Years? *Anſw.* 5 *per Cent.*

4. *When* P, A, R, *are given, to find* T.

RULE. $\frac{a}{p} = rt$; which being divided by R till Nothing remains, the Number of thoſe Diviſions will be equal to T.

EXAMPLES.

In what Time will £450 amount to £520,93125, at 5 *per Cent.*? *Anſw.* 3 Years.

$\frac{520,93125}{450} = \frac{1,157625}{1,05} = \frac{1,1025}{1,05} = \frac{1,05}{1,05} = 1$; the Number of Diviſions being 3 = to the Time ſought.

In

In what Time will £400 amount to £486 4,050 at 5 *per Cent.*? *Answ.* 4 Years.

Annuities *or* Pensions *in* Arrears.

Note. U represents the Annuity.
A, R, T, as before.

A Table, *shewing the* Amount *of* 1l. *Annuity for any Number of Years under* 31, *at* 5, *and* 6 *per Cent. per Ann.*

Years.	Rates. 5	Rates. 6	Years.	Rates. 5	Rates. 6
1	1,00000	1,00000	16	23,65749	25,67252
2	2,05000	2,06000	17	25,84036	28,21288
3	3,15250	3,18360	18	28,13238	30,90565
4	4,31012	4,37461	19	30,53900	33,75999
5	5,52563	5,63709	20	33,06595	36,78559
6	6,80191	6,97532	21	35,71925	39,99272
7	8,14200	8,39383	22	38,50521	43,39229
8	9,54910	9,89746	23	41,43047	46,99582
9	11,02656	11,49131	24	44,50199	50,81557
10	12,57789	13,18079	25	47,72709	54,86451
11	14,20678	14,97164	26	51,11345	59,15638
12	15,91712	16,86994	27	54,66912	63,70576
13	17,71298	18,88213	28	58,40258	68,52811
14	19,59863	21,01506	29	62,32271	73,63979
15	21,57856	23,27597	30	66,43884	79,05818

Note. The Table is made thus; take the first Year's Amount; which is 1l. multiply it by 1,05 + 1 = 2,05, the second Year, &c.

1. *When* U, T, R, *are given, to find* A.

Rule. $\frac{urt - u}{r - 1}$ = A. Or by the Table thus: Multiply the Amount of 1l. for the Number of Years, and at the Rate *per Cent.* given in the Question by the Annuity, and it will give the Answer.

Examples.

In

EXAMPLES.

What will an Annuity of £ 100 *per Annum*, payable yearly, amount to in 4 Years, at 5 *per Cent.*?

Answ. £ 431 0 3

$1{,}05 \times 1{,}05 \times 1{,}05 \times 1{,}05 \times 100 = £121{,}5506250$:

Then $\frac{121{,}550625 - 100}{1{,}05 - 1} = £431\ 0\ 3$; by the Table thus; $4{,}31012 \times 100 = £431\ 0$ 2d.3,52.

What will a Pension of £ 90 *per Annum*, payable yearly, amount to in 4 Years, at 5 *per Cent.*?

Answ. £ 497 6 1½,54.

2. *When* A, R, T, *are given, to find* U.

RULE. $\frac{ar - a}{rt - 1} = U$.

EXAMPLES.

What Annuity, being forborne 4 Years, will amount to £ 431 0 3, at 5 *per Cent.*? *Answ.* £ 100 0 0.

$$\frac{431{,}0125 \times 1{,}05 - 431{,}0125}{1{,}05 \times 1{,}05 \times 1{,}05 \times 1{,}05 - 1} = £100.$$

What Pension, being forborne 5 Years, will amount to £ 497 6 1½,54, at 5 *per Cent.*? *Answ.* £ 90

3. *When* U, A, R, *are given, to find* T.

RULE. $\frac{ar + u - a}{u} = rt$; which, being continually divided by R till Nothing remains, the Number of those Divisions will be equal to T.

EXAMPLES.

In what Time will 100 l. *per Annum* amount to 431 l. 0 s. 3 d. at 5 *per Cent.* for Non-Payment? *Answ.* 4 Y.

$$\frac{431{,}0125 \times 1{,}05 + 100 - 431{,}0125}{100} = 1{,}21550625;$$

which

which being continually divided by R till Nothing remains, the Number of those Divisions will be = 4 Years.

In what Time will 90 l. *per Annum*, at 5 *per Cent.* amount to £ 497 6 $1\frac{1}{2}$,54? *Answ.* 5 Years.

Present Worth *of* Annuities, &c.

A Table *shewing the present Worth of* 1 l. *Annuity for any Number of Years under* 31, *Rebate at* 5 *and* 6 *per Cent.*

Yrs.	5 Rates.	6	Yrs.	5 Rates.	6
1	0,95238	0,94339	16	10,83777	10,10589
2	1,85941	1,83339	17	11,27406	10,47726
3	2,72324	2,67301	18	11,68958	10,82760
4	3,54595	3,46510	19	12,08532	11,15811
5	4,32947	4,21236	20	12,46221	11,46992
6	5,07569	4,91732	21	12,82115	11,76407
7	5,78637	5,58238	22	13,16300	12,04158
8	6,46321	6,20979	23	13,48857	12,30338
9	7,10782	6,80169	24	13,79864	12,55035
10	7,72173	7,36008	25	14,09394	12,78335
11	8,30641	7,88687	26	14,37518	13,00316
12	8,86325	8,38384	27	14,64303	13,21053
13	9,39357	8,85268	28	14,89812	13,40616
14	9,89864	9,29498	29	15,14107	13,59072
15	10,37965	9,71225	30	15,37245	13,76483

Note. The above Table is made thus: Divide 1 l. by 1,05 = 95238, the present Worth of the first Year; which ÷ 1,05 = 90703, added to the first Year's present Worth = 1,85941, the second Year's present Worth; then 90703 ÷ 1,05 + 1,85941 = to 2,72324, the third Year's Worth; and so on.

1. *When* U, T, R, *are given, to find* P.

Rule. $\dfrac{u - \dfrac{u}{r^t}}{r - 1} = P$. Or by the Table thus: Multiply the present Worth of 1 l. Annuity for the Time and Rate

Rate *per Cent.* given by the Annuity, and it will give the Answer.

EXAMPLES.

What is the present Worth of an Annuity of 60 l. *per Annum*, to continue 7 Years, at 6 *per Cent.*?

Answ. £ 334 18 10,368.

$$\frac{60}{1,50363} = 39,9034\,;\quad 60 - 39,9034 = \frac{20,0966}{1,06-1}$$

$= £\,334,9432.$

What is the present Worth of a Pension of 80 l. *per Annum*, to continue 8 Years, at 5 *per Cent.*?

Answ. £ 517 1 1½,528.

2. *When* P, T, R, *are given, to find* U.

RULE. $\frac{prt \times r - prt}{rt - 1} = U.$

EXAMPLES.

If an Annuity be purchased for £ 334,9432, to continue 7 Years, at 6 *per Cent.* what is the Annuity?

Answ. £ 60 0 0.

$$\frac{334,9432 \times 1,50363 \times 1,06 - 334,9432 \times 1,50363}{1,50363 - 1}$$

$= £\,60\ 0\ 0.$

If the present Worth of an Annuity, 8 Years to come, be £ 517 1 1½,528, at 5 *per Cent.* what was the Annuity?

Answ. £ 80 0 0.

3. *When* U, P, R, *are given, to find* T.

RULE. $\frac{u}{p + u - pr} = rt$; which being continually divided by R till Nothing remains, the Number of these Divisions will be equal to T.

EXAMPLES.

EXAMPLES.

How long may a Lease of 60 l. yearly Rent be had for £334,9432, allowing 6 *per Cent.* to the Purchaser?

Answ. 7 Years.

$$\frac{60}{334{,}9432+60-355{,}039792} = 1{,}50363.$$ Which being divided continually, the Number of those Divisions will be = T = 7 Years.

If £517 1 1⅗,528 is paid down for a Lease of 80 l. *per Annum*, at 5 *per Cent.* how long is the Lease purchased for?

Answ. 8 Years.

ANNUITIES, LEASES, &c. *taken in* REVERSION.

RULE 1. Find the present Worth of the Annuity, &c. at the given Rate, and for the Time of its Continuance thus; $\dfrac{u - \frac{u}{rt}}{r-1} = P$.

2. Change P into A, and find what Principal, being put to Interest, will amount to P, at the same Rate, and for the Time to come before the Annuity commences; which will be the present Worth of the Annuity, &c. thus; $\frac{a}{rt} = P$.

EXAMPLES.

What is the present Worth of a Reversion of a Lease of £80 *per Annum*, to continue for 6 Years, but not to commence till the End of 2 Years, allowing 6 *per Cent.* to the Purchaser?

Answ. £350 2 3-,096 qrs.

$$\frac{80}{1{,}41852} = 56{,}3968;\ \frac{80-56{,}3968}{1{,}06-1} = \frac{393{,}3866}{1{,}1236} =$$ £350,1126.

What is the present Worth of a Reversion of £120 *per Annum*, to continue 7 Years, but not to commence till the End of 3 Years, allowing 5 *per Cent.* to the Purchaser?

Answ. £599 16 4,8.

To

To find the yearly Income of an Annuity, &c. taken in Reversion.

RULE. Find the Amount of the present Worth, at the given Rate, and for the Time before the Annuity commences, thus; $pr^t = A$. Invert A into P, and find what yearly Rent, being sold, will produce P at the same Rate, and for the Time of its Continuance; which will be the yearly Sum required, thus; $\frac{pr^t \times r - pr^t}{r^t - 1} = U$.

EXAMPLES.

What Annuity, to be entered upon 2 Years hence, and then to continue 6 Years, may be purchased for £350,1126, at 6 *per Cent.*? *Answ.* £80 0 0

$350,1126 \times 1,1236 = 393,3866$; then

$\frac{393,3866 \times 1,41852 \times 1,06 - 558,02674}{1,41852 - 1} = £80\ 0\ 0.$

The present Worth of a Lease of a House is 599 l. 16 s. 4,8 d. taken in Reversion for 7 Years, but not to commence till the End of 3 Years, allowing 5 *per Cent.* to the Purchaser, what is the yearly Rent? *Answ.* £ 120.

PURCHASING *of* FREEHOLD *or* REAL ESTATES.

1. *When* U, R, *are given, to find* W.

RULE. $\frac{u}{r - 1} = W$.

EXAMPLES.

What is the Value of a freehold Estate of 100 l. *per Annum*, allowing 5 *per Cent.* to the Buyer? *Answ.* £ 2000.

$\frac{100}{1,05 - 1} = 2000.$

N What,

What is an Estate of 150 l. *per Annum* worth, allowing 3 *per Cent.* to the Buyer? *Answ.* £ 5000.

2. *When* W, R, *are given, to find* U.

RULE. $w \times r - 1 = U$.

EXAMPLES.

If a freehold Estate is bought for £ 2000, and the Allowance to the Buyer is 5 *per Cent.* what is the yearly Rent? *Answ.* £ 100.

$$2000 \times 1{,}05 - 1 = 100 \text{ l.}$$

If an Estate be sold for £ 5000, and 3 *per Cent.* allowed to the Buyer, what is the yearly Rent? *Answ.* £ 150.

3. *When* W, U, *are given, to find* R.

RULE. $\frac{w + u}{w} = R$.

EXAMPLES.

If an Estate of 100 l. *per Annum* is bought for 2000 l. what is the Rate *per Cent.*? *Answ.* 5 *per Cent.*

$$\frac{1000 + 50}{1000} = 1{,}05 = 5 \text{ per Cent.}$$

If a freehold Estate of 150 l. *per Annum* is bought for 5000 l. what was the Rate *per Cent.* *Answ.* 3 *per Cent.*

PURCHASING FREEHOLD ESTATES *in* REVERSION.

RULE. Find the Worth of the yearly Rent thus: $\frac{u}{r-1} = W$. Change W into A, and find what Principal being put to Interest will amount to A at the same Rate and for the Time to come before the Estate commences, and that will be the Worth of the Estate in Reversion. Thus, $\frac{a}{r^t} = P$.

EXAMPLES.

EXAMPLES.

If a freehold Estate of 100 l. *per Annum*, to commence 4 Years hence, is to be sold, what is its Worth, allowing the Purchaser 5 *per Cent.* for present Payment?

$$\frac{100}{1,05 - 1} = 2000: \text{ Then } \frac{2000}{1,2155} = £\,1645\ \ 8\ \ 3.$$

What is an Estate of 400 l. *per Annum*, to continue for ever, but not to commence till the End of 2 Years, worth in ready Money, allowing the Purchaser 4 *per Cent.*? *Answ.* £ 9245 11 2,88.

To find the yearly Value of an Estate taken in Reversion.

RULE. Find the Amount of the Worth of the Estate at the given Rate and Time before it commences.

Thus, $wr^t = A$.

2. Change A into W, and find what yearly Rent being sold will produce U at the same Rate: Thus,

$\frac{wr \times r - wr}{r}$ = U: which will be the yearly Rent required.

EXAMPLES.

If a freehold Estate, to commence 4 Years hence, is sold for £ 1645 8 3, allowing the Purchaser 5 *per Cent.* what is the yearly Income? *Answ.* 100 l.

1645,41250 × 1,2155 = 2000: Then,

$$\frac{2000 \times 1,05 \times 1,05 - 2100}{1,05} = 100 \text{ l.}$$

A freehold Estate is bought for £ 9245 11 2,88, which does not commence till the End of 2 Years, the Buyer being allowed 4 *per Cent.* I desire to know the yearly Income? *Answ.* 400 l.

REBATE OR DISCOUNT.

A TABLE *shewing the present Worth of* 1 l. *due at any Number of Years to commence under* 31, *Rebate at* 5 *and* 6 *per Cent.*

Yrs.	5 Rates.	6	*Yrs.*	5 Rates.	6
1	,952381	,943396	16	,458111	,393647
2	,907030	,889996	17	,436296	,371364
3	,863838	,839619	18	,415520	,350343
4	,822702	,792093	19	,395734	,330513
5	,783526	,747258	20	,376889	,311804
6	,746215	,704960	21	,358942	,294155
7	,710682	,665057	22	,341849	,277505
8	,676839	,627412	23	,325571	,261797
9	,644609	,591898	24	,310067	,246978
10	,613913	,558394	25	,295302	,232998
11	,584679	,526787	26	,281240	,219810
12	,556837	,496969	27	,267848	,207368
13	,530321	,468839	28	,255093	,195630
14	,505068	,442301	29	,242946	,184556
15	,481017	,417265	30	,231377	,174110

Note. The above Table is made thus; 1 ÷ 1,05 = 952381, the first Year's present Worth; and 952381 ÷ 1,05 = 90703, the second Year; and 90703 ÷ 1,05 = 863838, the third Year, &c.

1. *When* S, T, R, *are given, to find* P.

RULE. $\frac{s}{rt} = P$.

EXAMPLES.

What is the present Worth of £ 631 4 8,4 payable 4 Years hence, at 6 *per Cent.*? *Answ.* £ 500.

1,06 × 1,06 × 1,06 × 1,06 = 1,26247;

then $\frac{631,2350}{1,26247}$ = £ 500.

By the Table, 631,235
,792093
£ 500.

If

If £ 689 9 6 3,84 qrs. be payable in 7 Years Time, what is the present Worth, Rebate being made at 5 *per Cent.*? *Answ.* £ 490.

2. *When* P, T, R, *are given, to find* S.

Rule. $p \times rt = S$.

Examples.

If a Sum of Money, due 4 Years hence, produce £ 500 for the present Payment, Rebate being made at 6 *per Cent.* what was the Sum first due? *Ans.* £ 689 9 6 3,84.

Answ. 500 × 1,26247 = £ 689 9 6 3,84.

If £ 490 be received for a Debt payable 7 Years hence, and an Allowance of 5 *per Cent.* to the Debtor for present Payment, what was the Debt? *Ans.* £ 689 9 6 3,84.

3. *When* S, P, R, *are given, to find* T.

Rule. $\frac{s}{p} = rt$; which being continually divided by R till Nothing remains, the Number of those Divisions will be = T.

Examples.

The present Payment of £ 500 is made for a Debt of £ 631 4 8,4, Rebate at 6 *per Cent.* in what Time was the Debt payable? *Answ.* 4 Years.

Answ. $\frac{631,2350}{500} = 1,26247$; which being continually divided, those Divisions will be = 4 = to the Number of Years.

A Person receives £ 490 now for a Debt of £ 689 9s. 6d. 3,84 Rebate at 5 *per Cent.* I demand in what Time the Debt was payable. *Answ.* 7 Years.

4. *When* S, P, T, *are given, to find* R.

Rule. $\frac{s}{p} = rt$; which being extracted by the Rule of Extraction, the Time given in the Question shewing the Power, will be = R.

EXAMPLES.

A Debt of £ 631 4 8,4 is due 4 Years hence, but it is agreed to take £ 500 for present Payment; at what Rate *per Cent.* is the Rebate made?

Answ. $\frac{631,2350}{500} = \sqrt[4]{1,26247} = 1,06 = 6$ *per Cent. Answ.*

The present Worth of £ 689 9 6 3,84, payable 7 Years hence, is £ 490; at what Rate *per Cent.* is Rebate made? *Answ.* 5 *per Cent.*

OF THE POWERS AND ROOTS OF NUMBERS.

1. Putting A for any Number, its 1st, 2d, 3d, &c. Powers will be A, A × A, A × A × A, &c. and its 1st, 2d, and 3d, &c. Roots will be those Numbers whose 1st, 2d, and 3d, &c. Powers are equal to A. Thus the 1st, 2d, and 3d Powers of 4 are 4, 16, 64, and the 1st, 2d, and 3d Roots of 64 are 64, 8, and 4, respectively.

2. The second and 3d Powers are commonly called the Square and Cube, and the 2d and 3d Roots the Square Root and Cube Root. Thus 64 is the Square of 8, and 8 is the Cube of 2: Also 4 is the Square Root of 16, and 2 is the Cube Root of 8.

3. Putting A for any Number as before, its 1st, 2d, 3d, &c. Powers and Roots may be denominated respectively thus;

Powers, A^1 A^2 A^3 A^4 A^5 &c.
Roots, $A^{\frac{1}{1}}$, $A^{\frac{1}{2}}$, $A^{\frac{1}{3}}$, $A^{\frac{1}{4}}$, $A^{\frac{1}{5}}$, &c.

But it must be observed that when the given Number consists of several Terms, a Line must be drawn over them, otherwise the Sign of the Power or Root (commonly called the Index or Exponent) will relate only to the Term over which it stands. To make this Method of Notation plain take these Examples.

$3^2 = 9$; $\overline{2+4}|^2 = 36$; $2 + 4^2 = 18$; $\overline{\frac{5}{7}}|^3 = \frac{125}{343}$;

$\frac{5^3}{7} = \frac{125}{7}$; $\frac{5}{7^3} = \frac{5}{343}$; $9^{\frac{1}{2}} = 3$; $\overline{12+13}|^{\frac{1}{2}} = 5$;

$4^{\frac{1}{2}} + 37 = 39$; $\overline{\frac{64}{25}}|^{\frac{1}{2}} = \frac{4}{5}$; $\frac{8^{\frac{1}{3}}}{125} = \frac{2}{125}$; $\frac{8}{125^{\frac{1}{3}}}$

$= \frac{8}{5}$; $\overline{2^2}|^3 = 64$; and $\overline{64^{\frac{1}{2}}}|^{\frac{1}{3}} = 2$.

4. A Power of a Root, or a Root of a Power, may be denominated by putting the Exponent of the Power above the Denominator of the Exponent of the Root; thus the Square of the Cube Root, or the Cube Root of the Square, of 8, may be denoted thus: $8^{\frac{2}{3}}$.

5. Powers or Roots, denoted as above, are called exponential Numbers, the chief Properties of which are: 1st. When a Number has two Exponents they may change Places thus: $\overline{8^{\frac{1}{2}}}|^{\frac{1}{3}} = \overline{8^{\frac{1}{3}}}|^{\frac{1}{2}} = 2^{\frac{1}{2}}$. 2d. The Terms of a fractional Exponent may be multiplied or divided each by the same Number thus: $8^{\frac{12}{9}} = 8^{\frac{4}{3}} = 2^4 = 16$. 3d. When a Number has two Exponents you may put their Product instead of them thus; $\overline{27^{\frac{1}{2}}}|^{\frac{2}{3}} = 27^{\frac{2}{6}} = 27^{\frac{1}{3}} = 3$. 4th. Putting m, n, for any Exponents, and A as before, then will $A^m \times A^n = A^{m+n}$. Thus $27^2 \times 27^3 = 27^5$, and $27^{\frac{1}{2}} \times 27^{\frac{5}{6}} = 27^{\frac{4}{3}} = 3^4 = 81$. 5th. Putting B for any other Number, we have $A^m \times B^m = \overline{A \times B}|^m$. Thus, $125^3 \times 8^3 = 1000^3$; $9^{\frac{1}{3}} \times 24^{\frac{1}{3}} =$

$= 216^{\frac{1}{3}} = 6$; and $5^{\frac{1}{3}} \times 5^{\frac{1}{2}} = 25^{\frac{1}{2}} = 5$. 6th. $A^m \div A^n = A^{m-n}$, when n is less than m. When it is greater, place the Difference of m and n over A, as an Exponent, and 1 over the Whole as a Numerator; thus $8^5 \div 8^2 = 8^3$; $8^{\frac{5}{6}} \div 8^{\frac{1}{2}} = 8^{\frac{1}{3}} = 2$; and $8^2 \div 8^4 = \frac{1}{8^2} = \frac{1}{64}$. 7th. $A^m \div B^m = \overline{A \div B}|^m$. Thus, $8^3 \div 2^3 = 4^3$; and $8^{\frac{1}{2}} \div 2^{\frac{1}{2}} = 4^{\frac{1}{2}} = 2$.

6. The finding any Power is called Involution, and the finding any Root Evolution or Extraction.

INVOLUTION.

RULE. Multiply as many Factors together as there are Units in the Exponent of the required Power, each Factor being equal to the given Number.

EXAMPLES.

What is the Square or 2d Power of 30?

$$\begin{array}{r} 30 \\ 30 \\ \hline 900 \end{array}$$

Ans. 900.

What is the third Power of 25? *Answ.* 15625.

What is the Cube or third Power of 30,75? *Ans.*

What is the Square of $11\frac{1}{2}$? *Answ.* 132,25.

RULE 2. When the required Power is above the Cube, apply the 4th and 6th Powers of exponential Numbers.

EXAMPLES.

What is the 8th Power of 7? *Answ.* 1443001.

What

What is the 12th Power of $\frac{1}{8}$? *Answ.* $\frac{1}{68719476736}$.

What is the 24th Power of ,4?

Answ. ,00000000001759218604441 6.

EVOLUTION.

EXTRACTION OF THE SQUARE ROOT

Is finding out such a Number as (multiplied by itself) the Product will be equal to the given Number.

TABLE.

Squares.	1	4	9	16	25	36	49	64	81
Roots.	1	2	3	4	5	6	7	8	9

RULE. When the given Number is an Integer, separate the Figures into Periods, by pointing off every two Figures from Right to Left; then from the first Period on the Left subtract the greatest Square contained in it, putting the Root on the Right as the first Figure of the required Root; to the Remainder annex the next Period for a Dividend, and double the Part of the Root already found for a Divisor; ask how often the Divisor is contained in the Dividend, neglecting the Right-Hand Figure; annex the Answer (not exceeding 9) to the former Part of the Root, and also to the Divisor; which, thus increased, must be multiplied by the new Figure; and then you must subtract the Product from the Dividend: Go on in this Manner till all the Periods are used; then, if Nothing remains, you will have the required Root complete; if any Thing remains, you cannot have it exactly; but, putting a Decimal Point after the Figures already found, and annexing Periods of Ciphers to the Remainders, you may, by proceeding as before, find it as nearly as you please.

EXAMPLES.

EXAMPLES.

What is the Square Root of 106929? *Answ.* 327.

```
        9
       ---
   62)169
      124
      ---
  647)4529
      4529
      ----
      ....
```

What is the Square Root of 7598? *Answ.* 87,1+.
What is the Square Root of 129647? *Answ.* 360,06+.
What is the Square Root of 3698754? *Answ.* 1923,2+.
What is the Square Root of 17,986? *Answ.* 4,2409+.
What is the Square Root of 1234,75? *Answ.* 35,1+.
What is the Square Root of 47,96? *Answ.* 6,9+.

To extract the Square Root of a Vulgar Fraction.

RULE. Reduce the Fraction to its lowest Terms; then extract the Square Root of the Numerator for a new Numerator, and the Square Root of the Denominator for a new Denominator. If the Fraction be a Surd, (*i. e.* a Number where a Root can never be found,) reduce it to a Decimal, and extract as before.

EXAMPLES.

What is the Square Root of $\frac{4}{36}$? *Answ.* $\frac{1}{3}$.
What is the Square Root of $\frac{16}{36}$? *Answ.* $\frac{2}{3}$.
What is the Square Root of $\frac{9}{144}$? *Answ.* $\frac{1}{4}$.

SURDS.

What is the Square Root of $\frac{8}{9}$? *Answ.* ,298+.
What is the Square Root of $1\frac{1}{6}$? *Answ.* 1,08+.
What is the Square Root of $\frac{3}{4}$? *Answ.* ,866+.

To

To extract the Square Root of a mixed Number.

RULE. Reduce the fractional Part of the mixed Number to its lowest Terms, and then the mixed Number to an Improper Fraction.

2. Extract the Roots of the Numerator and Denominator for a new Numerator and Denominator.

If the mixed Number be a Surd, reduce the fractional Part to a Decimal, and extract as before.

EXAMPLES.

What is the Square Root of $5\frac{4}{9}$? *Answ.* $2\frac{1}{3}$.
What is the Square Root of $6\frac{1}{4}$? *Answ.* $2\frac{1}{2}$.
What is the Square Root of $20\frac{1}{4}$? *Answ.* $4\frac{1}{2}$.

SURDS.

What is the Square Root of $7\frac{5}{9}$? *Answ.* 2,75+.
What is the Square Root of $9\frac{1}{2}$? *Answ.* 3,08+.
What is the Square Root of $17\frac{5}{9}$? *Answ.* 4,18+.

EXTRACTION OF THE CUBE ROOT.

When the given Number is an Integer, separate the Figures into Periods, by pointing off every 3 Figures from Right to Left; then from the first Period on the Left-hand subtract the greatest Cube contained in it, putting the Root on the Right-hand as the first Figure of the required Root; to the Remainder annex the next Period for a Dividend, and take 300 Times the Square of the first Figure for a Divisor; ask how often the Divisor is contained in the Dividend; annex the Answer (not exceeding 9) to the former Part of the Root, and also to its Triple; which, thus increased, must be multiplied by the new Figure; call the Product A, and add it to the Divisor; call the Sum B, and multiply it by the new Figure; and you must subtract that Product from the Dividend: Go on, as in this last Step, till all the Periods are used, except finding the Divisor, which will be had by annexing two Ciphers to the Sum of A, B, and the

the Square of the last Figure; then, if Nothing remains, you will have the required Root complete; if any Thing remains, you cannot have it exactly; but by putting a Decimal Point after the Figures already found, and annexing Periods of Ciphers to the Remainders, you may, by proceeding as before, find it as nearly as you please.

TABLE.

Cubes.	1	8	27	64	125	216	343	512	729
Roots.	1	2	3	4	5	6	7	8	9

When a Decimal, Vulgar Fraction, or mixed Number is given, proceed as in the Square Root; observing, that in each Period after the first there must be three Figures.

EXAMPLES.

What is the Cube Root of 456789014705?

Answ. 7701+.

456789014705
343

14700)113789
113533 Subtrahend.

177870000)256014705
177893101 Subtrahend.

78121604 Remain.

77	217	7
77	7	7
539	1519 A	Square 49
539	14700	300
5929	16219 B	Div. 14700
300	7	
1778700	113533 Subtrahend.	
	23101 A	770

7701
7701

59305401
7701

456710893101
78121604

Proof 456789014705

770
770

592900
300

Divisor 177870000
23101 A

Subtrahend 177893101 B
1 New Figure.

Subtrahend 177893101

Note. When a Cipher is put in the Root, you have only to annex two Ciphers to the Divisor, and another Period to the Dividend, for a new Divisor and Dividend.

Proofs.

1. To the Cube of the Root add the Remainder; the Sum will be the given Number. Or, 2. cast the 9s out of the simple Values of the Figures in the Root, cube the Overplus, and cast the 9s out of the simple Values of the Figures in that Cube and the Remainder; the Overplus thence arising will be equal to that arising from casting the 9s out of the simple Values of the Figures in the given Number.

Of other Roots.

When the Denominator of the Exponent is the Product of Factors, each of which is 2 or 3, the Root may be found by an Extraction of the Square Root for each 2, and of the Cube Root for each 3. Thus, the 4th Root of 16 is equal to the Square Root of the Square Root of 16, which is 2; and the 6th Root, 4096, is equal to the Cube Root of the Square Root, or the Square Root of the Cube Root of 4096, which is 4. But the best *Method*, except for the Square and Cube Roots, is by a Table of Logarithms.

O Of

Of the Reciprocals of Numbers.

1. The Reciprocal of any Number may be found by dividing Unity by it; thus, the Reciprocal of 250 is $\frac{1}{250}$ = ,004.

2. Instead of multiplying by any Number, you may divide by its Reciprocal; and the contrary. Thus, 345 × 250 = 345 ÷ ,004 = 86250; and 345 ÷ 250 = 345 × ,004 = 1,380.

What is the Cube Root of 4758964? *Answ.* 168+.
What is the Cube Root of 1756059? *Answ.* 120+.
What is the Cube Root of 912673? *Answ.* 97.
What is the Cube Root of 10,5796? *Answ.* 2,19+.
What is the Cube Root of 175,9472? *Answ.* 5,60+.
What is the Cube Root of 147,5678? *Answ.* 5,28+.
What is the Cube Root of $\frac{5}{8}$? *Answ.* ,85498+.
What is the Cube Root of $\frac{4}{7}$? *Answ.* ,829+.
What is the Cube Root of $127\frac{7}{13}$? *Answ.* 5,0326+.
What is the Cube Root of $\frac{6859}{343}$? *Answ.* $2\frac{5}{7}$.
What is the Cube Root of $\frac{324}{1500}$? *Answ.* $\frac{3}{5}$.
What is the Cube Root of $15\frac{5}{8}$? *Answ.* $2\frac{1}{2}$.

EXTRACTION of the BIQUADRATE ROOT.

To extract the Biquadrate Root is to find out a Number, which, being involved four-times into itself, will produce the given Number.

Rule. First extract the Square Root of the given Number, and then extract the Square Root of that Square Root, and it will give the Biquadrate Root required.

Examples.

What is the Biquadrate Root of 531441? *Answ.* 27.
What is the Biquadrate Root of 33362176? *Ans.* 76.

THE

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Preceptor's Assistant,

OR,

SCHOOLMASTER's GUIDE.

PART III.

DUODECIMALS.

Rule. Multiply each Term in the Multiplicand (beginning at the lowest) by the Feet in the Multiplier, and put the Result under its respective Term, carrying an Unit, for every 12, from each lower Denomination to its next superior.

2. In the same Manner multiply the Multiplicand by the Primes in the Multiplier, and write the Result of each Term one Place more to the Right-Hand of those in the Multiplicand; and so on to the last.

Examples.

Multiply 6 F. 7 In. by 4 F. 9 In. *Ans.* 31 F. 3 In. 3 pts.

Duodecimals.	Cross Multip.	Decimals.	Practice.
6 × 7	6 × 7	6,5833	6 ½ 6 7
4 9	4 9	4,75	4 9
26 4	24	31,270675	3 ½ 26 4
4 11 3	2 4		3 3 6
31 3 3	4 6		1 7 9
	5 3		31 3 3
	31 3 3		

	F. In. P.		F. In. P.		F. In. P. 3ds. 4ths.
Multiply	6 7 5	by	7 4 2	*Anf.*	48 7 5 10 10
Multiply	3 7 9	by	1 4 7	*Anf.*	5 0 5 6 3
Multiply	7 4 6 5	by	3 1 4 9	*A.*	22 11 10 9 11 5 9
Multiply	3 7 9 5	by	3 7 9 5	*A.*	13 3 9 1 2 8 1

MENSURATION.

Definitions.

1. A Line is that which has Length only. — If all the Parts of a Line tend the fame Way, it is a right Line; if they continually vary their Directions, it is a curve Line.

2. A Superficies is that which has Length and Breadth only. If a right Line every Way coincides with a Surface, it is a plane Surface; if not, it is an irregular Surface.

3. A Solid is that which has Length, Breadth, and Thicknefs.

4. An Angle is the Inclination of two Lines, which meet in a Point, called the angular Point; and the Lines which form the Angle are called its Legs. A great Angle is obtufe, (that is, it is more than 90 Degrees,) and a lefs Angle acute. Obtufe and acute Angles are alfo called oblique Angles.

5. One Line is perpendicular to another when they make a right Angle.

6. Two ftrait Lines are parallel that have no Inclination to each other.

7. The Hypothenufe is the Side oppofite a right Angle.

8. A Parallelogram is a plain Surface bounded by four right Lines, the oppofite Sides being parallel. When the Angles of a Parallelogram are all right, it is called a Rectangle; when the Angles are all right, and the Sides all equal, it is called a Square. When the Sides are all equal, but not all the Angles, it is called a Rhombus. When neither Sides nor Angles are equal, it is called a Rhomboides. All other four-fided Figures are called Trapeziums. A right Line, joining any two oppofite Angles of a four-fided Figure, is called a Diagonal.

9. Plain

9. Plain Surfaces, bounded by more than four right Lines, are in general called Polygons. When the Sides and Angles of a Polygon are all equal, it is said to be regular; when otherwise, irregular. A Polygon of 5 Sides is called a Pentagon; one of 6, a Hexagon, *&c.*

10. A Circle is a plain Surface bounded by one curve Line called its Circumference, which is every where equally distant from a Point in the Circle called its Center. A right Line passing through the Center, and terminated both Ways by the Circumference, is called the Diameter of the Circle; Half of which is called the Radius; any Part of the Circumference is called an Arch; and a right Line, joining the Extremes of any Arch, is called its Chord or Subtense. A Segment of a Circle is any Part cut off by one right Line. A Sector of a Circle is any Part cut off by two Radii or Semidiameters, which are supposed not to make one right Line, and a Part of the Circumference; whence a Sector may be either less or greater than a Semicircle.

11. If a plain Surface be conceived to move for any Time in one Direction, parallel to its first Position, the Space moved through will be in the Form of a Solid, called a Prism; if the Base of a Prism be a Triangle, it is called a triangular Prism; if a Square, it is called a square Prism, *&c.* If the Base be a Parallelogram the Prism is called a Parallelopipedon; if a Circle, it is called a Cylinder. If the Sides and Ends be Squares the Prism is called a Cube. The Axis of a Prism is a right Line from the Middle of one End to that of the other.

12. If a Semicircle be conceived to move round its Diameter, the Space through which it moves will be in the Form of a Solid, called a Sphere or Globe. The Diameter or Axis of a Sphere is that of the Semicircle.

13. If a right Line, from any fixt Point above a Plane, be conceived to move round, so as to describe any Figure on the Plane, the Space inclosed by the Path of the Line will be in the Form of a Solid, called a Pyramid, of which the fixed Point is called the Vertex. If the Base be a Triangle it is called a triangular Pyramid; if a Square, it is called a square Pyramid, *&c.* If the Base be a Circle it is called a Cone. The Axis of a Pyramid is a right Line from the Vertex to the Middle of the Base.

A Pyramid or Prism is said to be right, if its Axis be perpendicular to the Base, and oblique if otherwise.

14. Any Part next the Top of a Pyramid or Sphere, cut off by a Plane parallel to the Plane of the Base, is called a Segment thereof, and the remaining Part a Frustum.

15. The five regular Bodies are the Tetrahedron, Hexahedron, Octahedron, Dodecahedron, and Icosahedron. The Tetrahedron is bounded by four equal equilateral Triangles; the Hexahedron by six equal Squares; the Octahedron by eight equal equilateral Triangles; the Dodecahedron by twelve equal regular Pentagons; and the Icosahedron by twenty equal equilateral Triangles.

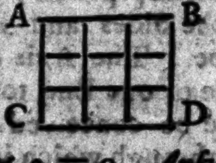
16. Similar Surfaces and Solids are those whose Bounds are similarly posited.

1. Of a Square.

Rule. Multiply the Side into itself, and the Product is the Content.

Example.

Let ABCD be a geometrical Square, each Side being 3 Feet, what is the superficial Content? *Answ.* 9 Feet.



$3 \times 3 = 9$. *Answ.*

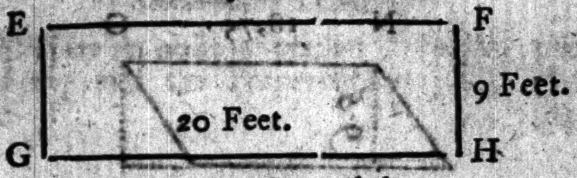
2. Of a Parallelogram.

Rule. Multiply the Length by the Breadth, and the Product is the Area.

Example.

Let EFGH be a Parellelogram, the Length 20 Feet, and the Breadth 9 Feet, what is the Area or superficial Content? *Answ.* 180 Feet.

E.



9 × 20 = 180. *Answ.*

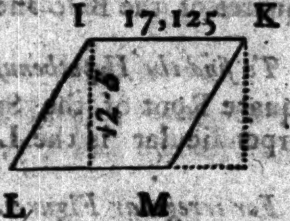
3. Of a Rhombus.

A Rhombus is a Figure representing a Quarry of Glass, having four equal Sides, the Opposites thereof being equal, two Angles being obtuse and two acute.

Rule. Multiply one of the Sides by a Perpendicular, let fall from one of the obtuse Angles to the opposite Side, and the Product is the Area.

Example.

Let IKLM be a Rhombus, whose Sides are each 17,125, and the Perpendicular 12,5, what is the Area of the Rhombus? *Answ.* 214,0625.



17,125 × 12,5 = 214,0625. *Answ.*

4. Of a Rhomboides.

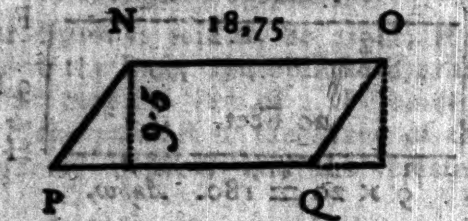
A Rhomboides is a Figure having four Sides, the Opposites whereof are equal and parallel; and also four Angles, the Opposites whereof are equal.

Rule. Multiply one of the longest Sides by the Perpendicular, let fall from one of the obtuse Angles, and the Product is the Area.

Example.

Let NOPQ be a Rhomboides, whose longest Side, NO or PQ is 18,75 Feet, and the Perpendicular 9,5, what is the Area? *Answ.* 178,125 Feet.

N



$18,75 \times 9,5 = 178,125$. *Answ.*

5. Of a Triangle.

1. *Let the Triangle be of any Kind.*

Rule. Multiply the Base by Half the Perpendicular, or Half the Base by the whole Perpendicular, or the whole Base by the whole Perpendicular, and take Half the Product, it will give the Content.

2. *To find any Side of a right-angled Triangle from the other two.*

Observe, the Square of the Hypothenuse is equal to the Sum of the Squares of the Base and Perpendicular.

3. *To find the Hypothenuse.*

Rule. The square Root of the Sum of the Squares of the Base and Perpendicular is the Length of the Hypothenuse.

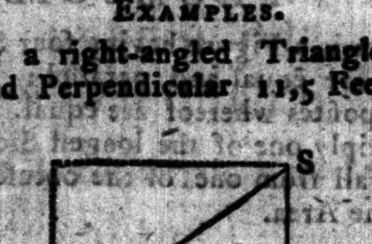
For irregular Figures.

Rule. Divide them into Triangles, and then proceed as in the Rule for Triangles.

Examples.

Let RST be a right-angled Triangle, whose Base is 14,2 Feet, and Perpendicular 11,5 Feet, what is the Area? *Answ.* 81,65.

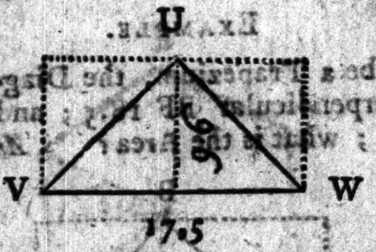
```
 14,2
 5,75
------
  710
 994
710
------
81,650
```




```
   11,5
   14,2
---------
2)163,30 An.
---------
   81,65
```

Let

Let VUW be an oblique-angled Triangle, whose Base is 17,5 Feet, and the Perpendicular 9,6; what is the Content? *Answ.* 84.



17,5 × 9,6 = 168 ÷ 2 = 84. *Answ.*

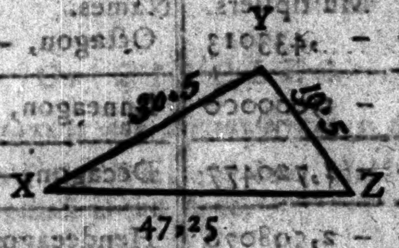
To find the Area of a Plane Triangle, by having the three Sides given, without the Help of a Perpendicular.

Rule. Add the three Sides together, and take Half that Sum; which done, multiply that Half and the three Differences continually, and out of the last Product extract the Square Root; it will give the Area.

Example.

Let XYZ be a Triangle, whose three Sides are, XZ = 47,25; XY = 30,5; and YZ = 19,5; what is the Area? *Answ.* 124,585.

Difference.
1,375
8,125
29,125



Sides.
47,25
30,5
19,5
2)97,25
48,625

48,625 × 29,125 × 8,125 × 1,375 = 15521,644287;
√15521,644287 = 124,585 Area, *Answ.*

Of a Trapezium.

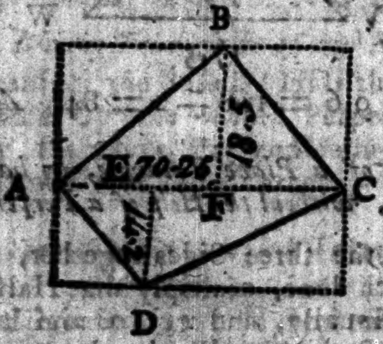
A Trapezium is a Figure having 4 unequal and oblique Angles.

Rule.

Rule. Add the two Perpendiculars together, and take Half the Sum, and multiply that Half-Sum by the Diagonal; the Product is the Area.

Example.

Let ABCD be a Trapezium, the Diagonal whereof is 70,25; the Perpendicular BF 18,5; and the Perpendicular DE 14,2; what is the Area? *Answ.* 1148,5875.



$$\frac{14,2 + 18,5}{2} \times 70,25 = 1148,5875 \text{ Area.}$$

Of Regular Polygons.

Names.	Multipliers.	Names.	Multipliers.
Trigon, - - -	,433013	Octagon, - -	4,828427
Tetragon, - -	1,000000	Enneagon, -	6,181827
Pentagon, - -	1,720477	Decagon, - -	7,694209
Hexagon, - -	2,598076	Hendecagon,	9,365641
Heptagon, - -	3,633959	Dodecagon,	11,196152

To find the Area of any regular Polygon.

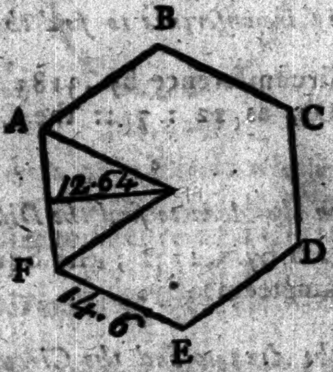
Rule. Multiply the Perimeter, or Sum of the Sides, by Half the Perpendicular let fall from the Center to the Middle of one of the Sides.

Examples.

EXAMPLES.

Let ABCDEF be a regular Hexagon, each Side being 14,6, and the Perpendicular 12,64; what is the Area.

Answ. 553,632.



14,6 × 6 = 87,6 × 6,32 = 553,632.

What is the Area of a regular Octagon whose Side is 10 Yards? *Answ.* 482,8427 Sq. Yards.

Note. The best Method is by a trigonometrical Table, which is found by this Rule, thus. —— Find the Angle at the Center of the Polygon, by dividing 360 Degrees by the Number of Sides in the Polygon; then multiply the Square of one of its Sides by the trigonometrical Number: The Product is the Area of the Polygon.

OF CIRCLES.

1. *From the Diameter and Circumference to find the Area.*

Multiply Half the Diameter into Half the Circumference; the Product is the Area.

2. *From the Diameter to find the Area.*

Multiply the Square of the Diameter by ,7854; the Product is the Area nearly.

3. *From the Circumference to find the Area.*

Multiply the Square of the Circumference by ,07957; the Product is the Area.

4. *From*

4. From the Diameter to find the Circumference.

Multiply the Diameter by 3,1416; or, as 7 : 21,998 :: the Diameter to the Circumference.

5. From the Circumference to find the Diameter.

Multiply the Circumference by ,3183; the Product is the Diameter: Or, as 22 : 7 :: the Circumference to the Diameter.

6. From the Area to find the Diameter.

Multiply the Area by 1,2732; the Square Root of the Product is the Diameter nearly.

7. From the Area to find the Circumference.

Multiply the Area by 12,56637; the Square Root of the Product is the Circumference nearly.

8. To find the Length of any Part of the Circumference.

From eight-times the Chord of Half the Arch take the Chord of the whole Arch; one Third of the Remainder is the Length required, nearly.

9. To find the Area of a Sector of a Circle.

Multiply Half the Arch by Half the Diameter; the Product is the Area.

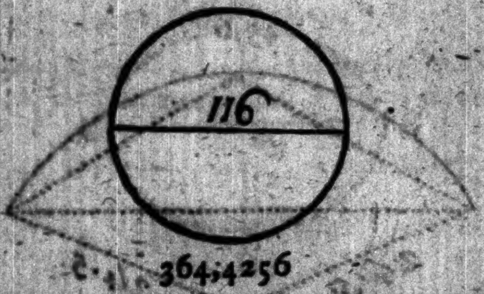
10. To find the Area of a Segment of a Circle.

To the Chord of the whole Arch add $1\frac{1}{3}$ of the Chord of Half the Arch, and multiply the Sum by the Height of the Segment; $\frac{2}{5}$ of the Product is the Area nearly.

EXAMPLES.

What is the Area of a Circle whose Diameter is 116, and Circumference 364,4256? *Answ.* 10568,3424.

116



What is the Area of a Circle whose Circumference is 112? *Answ.* 112 × 112 = 12544 × ,07957 = 998,12608.

What is the Circumference of a Circle whose Diameter is 116? *Answ.* 116 × 3,1416 = 364,4256.

What is the Diameter of a Circle whose Circumference is 364,4256? *Answ.* 116.

364,4256 × ,3183 = 116.

What is the Diameter of a Circle whose Area is 10568,3424? *Answ.* 116.

$\sqrt{10568,3424 \times 1,2732} = 116.$

What is the Circumference of a Circle whose Area is 10,568,3424? *Answ.* 364,4256.

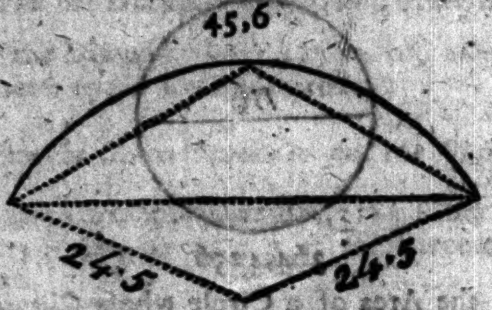
$\sqrt{10,568,3424 \times 12,56637} = 364,4256.$

The Chord of an Arch of a Circle is 9 Feet, and the Chord of Half the Arch is 5 Feet; what is the Length of the whole Arch? *Answ.* $9\frac{1}{3}$ Feet.

$$\frac{5 \times 8 = 40 - 12}{3} = 9\tfrac{1}{3}$$

What is the Area of a Sector of a Circle, the Radius being 24,5, and the Arch 45,6?

P 45,6



$$\frac{45,6}{2} \times 24,5 = 558,6 \textit{ Answ.}$$

The Chord of the Arch of a Segment of a Circle is 35; the Chord of Half the Arch 19,96; and the Height of the Segment 9,6; what is the Area? *Answ.* 236,59.

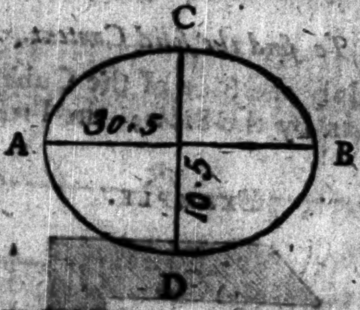
$$\overline{35 + 19,96 + 6,653 \times 9,6 \times 2} \div 5 = 236,599.$$

Of an Ellipsis.

An Ellipsis, or Oval, is a Figure bounded by a regular curve Line returning into itself: But, of its two Diameters, cutting each other in the Center, one is longer than the other; in which it differs from the Circle.

To find the Area.

Rule. Multiply the Transverse-Diameter by the Conjugate, and multiply that Product by ,7854, and the Quotient will be the Area of the Oval.



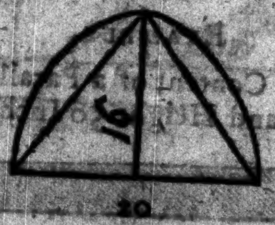
30,5 × 10,5 × ,7854 = 251,52435. *Answ.*

Of a Parabola.

A Parabola is a curvilineal Figure, made by the Section of a Cone, being cut by a Plane parallel to one of its Sides. Every Parabola is two-thirds of its circumscribing Parallelogram.

To find the Area.

Rule. Multiply the Base by the perpendicular Height, and that Product by 2, and divide that Product by 3; the Quotient is the Area.



20 × 16 × 2 ÷ 3 = 213,3.

Mensuration of Solids.

Solid Bodies are such as consist of Length, Breadth, and Thickness.

Of a Cube.

A Cube is a square Solid, comprehended under 6 geometrical Squares, being in the Form of a Die.

To find the solid Content.

Rule. Multiply the Side of the Cube into itself, and that Product again by the Side; the Product is the solid Content.

Example.

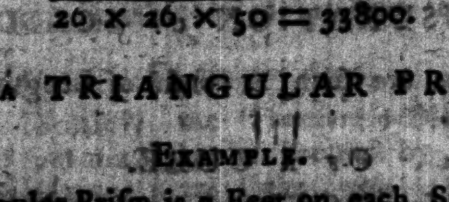
16,5 × 16,5 × 16,5 = 4492,125, the Cube.

Of a Parallelopipedon, or any Prism.

Rule. Multiply the Area of the Base by the perpendicular Height; the Product is the solid Content.

Example.

What is the solid Content of a Parallelopipedon, whose Base is 26 Inches, and Height 50 Inches? *Ans.* 33800.



26 × 26 × 50 = 33800.

Of a Triangular Prism.

Example.

If a triangular Prism is 7 Feet on each Side, and perpendicular 20 Feet, what is its Solidity?

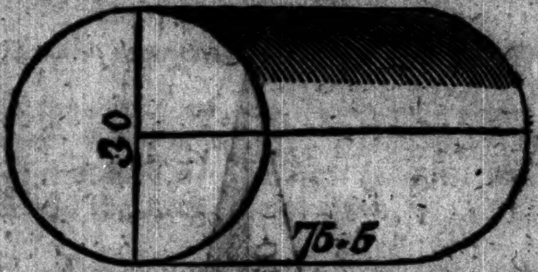
Answ. 60,62182.

$\overline{,433013 \times 7 \times 20} = 60,62182.$

Of a CYLINDER.

Example.

A Rolling-Stone is 30 Inches in Diameter, and 75,5 Inches long, what is its Solidity in Inches?



$\overline{7854 \times 30 \times 30 \times 75,5} = 53367,93$ *Answ.*

To find the superficial Content of a Prism.

Calculate the Areas of the Sides and Ends, and add them together; or, for a right Prism, multiply the Perimeter of either End into the Height, and to the Product add the Areas of both Ends.

Example.

What is the superficial Content of a Rolling-Stone, whose Diameter is 30 Inches, and Length 75,5?

Answ. 8469,444.

$\overline{3,1416 \times 30} \times 75,5 + 1413,72 = 8469,444.$
Area $706,86 + 706,86 = 1413,72.$

Of a CONE and a PYRAMID.

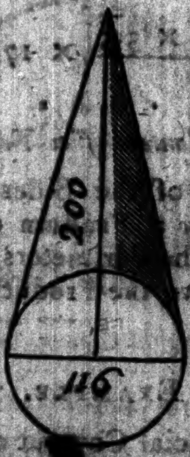
Rule. Multiply the Area of the Base by a third Part of the Altitude, the Product is the solid Content.

Examples.

Let ABC be a square Pyramid, each Side of the Base 9 Inches, and the Altitude or Height 20 Inches, what is the solid Content? *Answ.* 539,46.

$\overline{9 \times 9} = 81 \times 6,66 = 539,46.$

A Cone is 116 in Diameter at the Base, and the Height 200, what is it Solidity? *Answ.* 21136,6848.



$\overline{10568,3424} \times 200 = 2113 6,684800$ *Answ.*

To find the superficial Content of any Pyramid.

Calculate the Areas of the Sides and Base, and add them together; or, for a right Pyramid, multiply the Perimeter of the Base by the slant Height, and to Half the Product add the Area of the Base.

EXAMPLE.

What is the superficial Content of a right triangular Pyramid, each Side of the Base being 6 Feet, and the slant Height 18 Feet? *Answ.* 177,588468.

$\frac{6 \times 3 \times 18}{2} + ,433013 \times 6 \times 6 = 177,588468.$ *Ans.*

To find the solid Content of a Frustum of any Pyramid.

Add the Areas of both Ends to the square Root of their Product, and multiply the Sum by $\frac{1}{3}$ of the perpendicular Height.

EXAMPLE.

What is the solid Content of a Frustum of a square Pyramid, the Length of one End being 5,5, that of the other 3,5, and the perpendicular Height 17,75?

5,5

$$\frac{\overline{5{,}5}^2 + \overline{3{,}5}^2 + \sqrt{\overline{5{,}5}^3 \times \overline{3{,}5}^2}}{3} \times 17{,}75 = 365{,}35416 +$$

To find the superficial Content of a Frustum of any Pyramid.

Calculate the Areas of the Sides and Ends, and add them together; or, for a Frustum of a right Pyramid, multiply the Sum of the Perimeters of both Ends by the slant Height, and halve the Product, to which add the Areas of both Ends.

EXAMPLE.

What is the superficial Content of a Frustum of a right square Pyramid, the Length of one End being 20 Inches, that of the other 16 Inches, and the slant Height 40 Inches? *Answ.* 3536.

$$\frac{20 + 16 \times 4 \times 40}{2} + \overline{20}^2 + \overline{16}^2 = 3536 \text{ Inches.}$$

OF A SPHERE OR GLOBE.

A Sphere or Globe is a round solid Body, every Part of whose Surface is equally distant from a Point within it, called its Center.

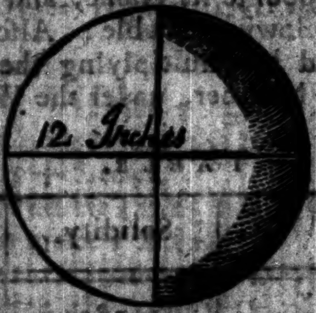
RULE. 1. Multiply the Axis or Diameter into the Circumference, the Product is the superficial Content; which multiplied by a sixth Part of the Diameter, the Product is the Solidity.

2. Or thus, as 21 is to 11 so is the Cube of the Diameter to the Solidity.

3. Or thus, as 1 is to ,5236 so is the Cube of the Diameter to the Solidity.

EXAMPLE.

My terrestrial Globe is 12 Inches in Diameter; what is its Solidity? *Answ.* 904,7808 Inches.



$$\overline{12 \times 12 \times 12 \times ,5236} = 904,7808 \text{ Inches.}$$

To find the Solidity of a Frustum or Segment of a Sphere.

To the Square of the Segment's Height add thrice the Square of its Radius; multiply the Sum by the Height, and that Product by ,5236.

To find the Superficies of a Segment of a Sphere.

Multiply the Circumference of the Sphere by the Height of the Segment.

EXAMPLES.

My Punch-bowl is 15 Inches Diameter, and 7 Inches deep; how many Gallons does it contain? *Ans.* 3,4 + Gall.

$$\overline{7,5}^2 \times 3 + \overline{7}^2 = 217,75.$$

$$\overline{217,75 \times 7 \times ,5236} = 798,09 \div 231 = 3,4 + . \textit{ Ans.}$$

A Globe is 20 Inches in Circumference, and a Segment is made whose Height is 3 Inches; what is the Content of the Superficies of the Segment?

Answ. 60 Inches.

$$20 \times 3 = 60.$$

OF THE FIVE REGULAR BODIES.

The solid Content of any one of these Bodies will be found nearly by multiplying the Cube of its linear Side into

into the Number opposite its Name, and under the Word Solidity, in the following Table: Also the superficial Content will be had by multiplying the Square of the linear Side into the Number, under the Word Surface.

TABLE.

Name.	Solidity.	Surface.
Tetrahedron, - - - -	,1178511	1,732058
Octahedron, - - - -	,4714045	3,464102
Hexahedron, - - - -	1,000000	6,000000
Icosahedron, - - - -	2,181695	8,660254
Dodecahedron, - - -	7,663119	20,645729

EXAMPLE.

What is the Solidity and superficial Content of a Tetrahedron, whose linear Side is 8,5?

$$,1178511 \times \overline{8,5}^3 = 72,3753067875. \quad \text{Solidity.}$$

$$1,7320508 \times \overline{8,5}^2 = 125,1406703. \quad \text{Surface.}$$

Of similar Surfaces and Solids.

1. Similar Surfaces are to one another as the Squares of their like Sides.

2. Similar Solids are to one another as the Cubes of their like linear Sides.

3. Circles are to one another as the Squares of their Diameters.

4. Spheres are to one another as the Cubes of their Diameters.

EXAMPLES.

There is a Piece of Ground in the Form of a regular Octagon, each Side being 11 Chains 20 Links, what is the

the Side of another regular Octagon, whose Area is thrice as much?

$1 : 3 :: \overline{11,2}^2 ; \overline{11,2}^2 \times 3 = 376,32$, the Square of the Side required; therefore the Side itself is, $\sqrt{376,32} = 19$ Chains, 39 + Links.

Note. One Hundred Links is 4 Poles or 1 Chain, and 10 square Chains make 1 Acre.

What must be the Diameter of a Pipe that will admit, in any Time, twice the Quantity of water admitted in the same Time by another Pipe of 4 Inches Diameter?

Answ. 5,6 Inches.

$1 : 2 :: \overline{4}^2 = 32$, whose square Root is 5,6+

If a Globe, 6 Inches in Diameter, weighs 10 lb. what will another Globe weigh whose Diameter is 12 Inches?

Answ. 80 lb.

$\overline{6}^3 : \overline{12}^3 ::$ 10 lb. = 80 lb.

Of irregular Solids.

The solid Content of an irregular Body may be found thus: Put it in a hollow Prism, into which pour Water till the Body be just covered, and mark the Vessel at the Surface of the Water; then take out the Body, and make a Mark again at the Surface of the Water, so will the Content of the Part of the Vessel between the Marks (which can easily be computed) be nearly equal to that of the Body.

OF GAUGING.

To find the Content of a Cask.

Find the Areas at the Head and Bung, add $\frac{1}{3}$ of the less and $\frac{2}{3}$ of the greater for a mean Area. This multiplied by the Length of the Cask is its Solidity in Inches, which reduce: Or, 2d. To Double the Square of the Bung Diameter add that of the Head, then multiply by the Length of the Cask, and divide by 1077,24 for Beer, or by 882,42 for Wine, Gallons. But the best Method to

to gauge a Cask is to find a mean Diameter, which will reduce the proposed Cask to a Cylinder.

EXAMPLES.

,7 × 8 = 5,6 + 24 = 29,6 = to the mean Diameter for the middle Frustum of a Spheroid.

8 × ,65 = 5,2 + 24 = 29,2 = to the mean Diameter for the middle Frustum of a parabolic Spindle.

8 × ,6 = 4,8 + 24 = 28,8, the mean Diameter for the lower Frustums of two equal parabolic Conoids.

8 × ,55 = 4,4 + 24 = 28,4 = to the mean Diameter for the lower Frustums of two equal Cones.

Note. If the Staves of a Cask be very much curved between the Head and Bung it is supposed to be the middle Frustum of a Spheroid; if less, it is the middle Frustum of a parabolic Spindle; if very little curved it is the lower Frustums of two equal parabolic Conoids; if the Staves between the Head and Bung are strait the Cask is taken to be the lower Frustums of two equal Cones, abutting or joining together upon one common Base.

EXAMPLES.

The famous Tun of *Heidelburgh*, that being heretofore annually replenished with Rhenish, had in it some Wine, that was many Ages old, before the *French* demolished it: It was 31 Feet in Length, 21 Feet in Diameter, and pretty nearly cylindrical; how many Tuns of Wine would the same contain had it been quite cylindrical?

Answ. 318 Tuns, 183 Gallons.

$\overline{21 \times 12 \times 252} \div 294,12 = 215,911872;$

$\overline{215,911872 \times 372} \div 252 = 318,727049$ Tuns.

$\overline{,727049 \times 252} = \frac{252}{183,216348}$ Gallons.

A Cask is the middle Frustum of a Spheroid, 32 Inches at the Bung, 24 Inches at the Head, and the Length 40 Inches, what is the Content of the Cask?

Answ. 97,4 Gallons.

The JULIAN CALENDAR reduced to the GREGORIAN or NEW STILE.

Of the Prime or Golden Number.

The Prime or Golden Number is a Revolution of 19 Years, in which Time the Moon returns to make the same Aspects with the Sun on the same Day of the Month (most commonly) that they were on 19 Years before.

To find it.

Rule. Add 1 to the Year of our Lord, and divide the Sum by 19, the Remainder is the Golden Number.

N.B. When 0 remains then 19 is the Golden Number.

Example.

I demand the Golden Number for the Year 1800?

1800
1
———
94)1801(19
94
———
861
846
———
Remainder 15 Golden Number.

Of the Epact.

The Epact is the Number of Days that the solar Year of 365 exceeds the lunar Year, or 12 Revolutions of the Moon, to the Sum of 354 Days, the Difference being 11 Days,

To find it.

Rule. Multiply the Prime or Golden Number by 11, and divide the Product by 30; the Remainder is the Epact for the Old Stile. Multiply the Prime by 11, and from the Product subtract 11, divide the Remainder by 30, and the Remainder of the Division is the Epact for the New Stile.

Example.

I demand the Epact for the Year 1800, New Stile?

Answ. 4, Epact.

Prime 15
11
———
165
11
———
30)154(5
150
———
4 Epact for 1800.

Note. When 0 remains 30 is the Epact.

To find the Moon's Age.

Rule. Add to the Epact for March 0 in common Years, and, in Leap-Years, for April 2, for May 3, for June 4, for July 5, for August 6, for September 8, for October 8, for November 10, for December 10, for January 0, for February 2. Having added to the Epact the Number for the Month, according to the Rule foregoing, add thereto the Day of the Month for which the Moon's Age is required; these three added together, if less than 30, is the Moon's Age; if more than 30, take 30 from it as often as you can, and the Remainder is the Age of the Moon.

The Moon's Age, subtracted from the Day of Change, leaves the Day of full Moon.

N. B. When 0 remains, that Day of the Month is the Day of Change.

Example.

EXAMPLE.

How old is the Moon on the 20th of May, 1800 ?

Epact	4
May	3
	20
	27 Days. *Answ.*

To find the Moon's Southing.

Multiply the Moon's Age by 4, and divide the Product by 5, the Quotient is the Hours of Southing ; and, for each 1 that remains, account 12 Minutes.

Note. If the Moon's Age exceed 15, reject the said 15, and with the Remainder proceed instead of the Moon's Age ; if the Moon's Age be above 15, the Time of Southing is before Noon ; but if less than 15, the Time of Southing is in the Afternoon. The new Moon is South at Noon, and the full Moon is South at Midnight.

EXAMPLE.

When is the Moon South, August 12, 1800 ?

Answ. 36 Minutes after 5 in the Morning.

Moon's Age	22
	15
	7
	4
	5)28
	$5\frac{3}{5}$ = to 36 Minutes.

To find the Dominical Letter.

Take the Year and its fourth Part, and add them together, divide the Sum by 7, and subtract what remains, from that Division, from the Divisor 7, the Remainder gives the Answer, accounting the Letter A for 1, B for 2, C for 3, D for 4, E for 5, F for 6, and G for 7.

EXAMPLE.

What is the Dominical Letter for 1800?

4)1800

450

7)2250

7

321 — 3

Remainder 4 the Dominical Letter.

RECREATIONS.

What is the Value of 14 Barrels of Soap, at 9 d. per lb. each Barrel containing 254 lb.? *Answ.* £ 133 7 0

What is the Interest of £ 700 for a Year, at $4\frac{1}{2}$ *per Cent.*? *Answ.* £ 31 10 0

If 6 lb. of Pepper be worth 19 lb. of Ginger, and 19 lb. of this be worth $4\frac{1}{2}$ lb. of Cloves, and 10 lb. of Cloves be equal to 63 lb. of Sugar at 5 d. per lb. what is the Value of 1 cwt. of Pepper? *Answ.* £ 7 2 $5\frac{187}{228}$

If, by selling Hops at £ 3 10 *per Cent.* the Planter clears 30 *per Cent.* what was his Gain *per Cent.* when the same Goods sold for £ 4 5? *Answ.* £ 57 17 $1\frac{5}{7}$

When the Sun is in the Meridian at *Ewell* in *Surry*, in what Time will it be so at *Kingston*, supposing it to lie due West of it, at the Distance of 5 measured Miles, in the Latitude of $51\frac{1}{2}$ Degrees, where the Degree of Longitude turns out $37\frac{12}{30}$ Miles, known by the diurnal Rotation of the Earth to pass in 4 Minutes' Time?

Answ. $32\frac{128}{1122}$ Seconds.

What Part of 3 d. is $\frac{1}{3}$ of 2 d.? *Answ.* $\frac{2}{9}$.

Three Persons entered Joint-Trade, to which A contributed £ 210, B £ 312; they cleared £ 140, whereof £ 37 10 of Right belongs to C: That Person's Stock and the several Gains of the other two are required?

Answ. C's Stock £ 190 19 6; A gained £ 41 4 $8\frac{1}{2}$.

A

A Mixture being made of 30 Gallons of Sack at 7s. per Gallon, and 12 Gallons of Lisbon at 5s. per Gallon, with 6 Gallons of Sherry at 4s. 6d. per Gallon; what is one Gallon of this Mixture worth? *Ans.* 6s. $2\frac{1}{4}$d.

London changes with *Amsterdam* at $34\frac{1}{3}$ s. per Pound; *Amsterdam* changes on *Middleburg* at 2 *per Cent.* Advance; how stands the Exchange between *London* and *Middleburg*? *Answ.* 35,02 *per* Pound Sterling.

A Gentleman delivered to his Friend a Sum of Money unknown, to receive Interest for the same at 5 *per Cent. per Annum*, Simple Interest, and at the End of 7 Years received, for Principal and Interest, £ 220; what was the Sum lent? *Answ.* £ 162 19 $3\frac{45}{135}$

What is the Difference of a solid Half-Foot, and Half a solid Foot? *Answ.* 648 cubic Inches.

A Goldsmith has 2 gold Cups of unequal Weight, having one Cover to both of 9 oz. now, if the Cover is put on the smaller Cup, it will be ½ the Weight of the greater Cup; and set on the greater Cup, it will be three times the Weight of the smaller Cup: What is the Weight of each Cup? *Answ.* Little Cup, 27 oz. great Cup, 72 oz.

What is the Sum of 16 Terms of the Progressional 3, 15, 75, *&c.* *Answ.* 114440917968

Note. The Sum of an infinite decreasing geometrical Progression will be found by dividing the first Term by the Difference between the common Multiplier and Unity, thus:

$$6 + 2 + \frac{2}{3} + \frac{2}{9}, \textit{ \&c. ad infinitum}, = \frac{6}{1-\frac{2}{3}} = 9.$$

If the $\frac{1}{5}$ of 8 be 4, what is the $\frac{1}{10}$ of 24? *Answ.* 6.

If the $\frac{5}{9}$ of $\frac{4}{7}$ of 20 is $\frac{2}{3}$ of $\frac{5}{6}$ of 30, what is $\frac{5}{11}$ of $\frac{9}{11}$ of $\frac{7}{8}$ of 81? *Answ.* $69\frac{1479}{7744}$

The continual Multiplication of the eight Digits will give the Number of Changes that may be rung on 8 Bells, as well as any other Combinations; how many are there? *Answ.* 40320.

There are two Numbers, the less 187, the Difference 34; give the Square of their Product, the Square of their Sum and Difference, and the Sum of those Squares.

Answ. Sum of Squares 1708088549.

In a Series of proportional Numbers the first is 5, the third 8, the Product of the second and third is 78,4; what is the Difference of the second and fourth?

Answ. 5,88.

B and C together build a Boat in 18 Days; with the Help of A they can do it in 11 Days; in what Time would A do it by himself? *Answ.* $28\frac{2}{7}$ Days.

What Fraction is that, to which if $\frac{3}{10}$ of $\frac{18}{7}$ of $\frac{14\frac{1}{3}}{21\frac{1}{3}}$ be added, the Total will be 1? *Answ.* $\frac{3648}{7455}$.

If $\frac{3}{7}$ of $\frac{4}{5}$ of $\frac{7}{8}$ of a Ship be worth $\frac{1}{5}$ of $\frac{6}{7}$ of $\frac{11}{13}$ of the Cargo, valued at £12000, what did both Ship and Cargo cost? *Answ.* £$15223\frac{221}{273}$.

Three Persons together purchased a *West-India* Ship, toward the Payment whereof A advanced $\frac{1}{4}$, B and C £140; how much paid A and B, and what Part had C?

Answ. A and B £$572\frac{8}{11}$; and C's Part $\frac{11}{56}$.

Hetty told her Brother *George*, that, though her Marriage took £19312 out of the Family, it was but $\frac{3}{5}$ of 2 Years Rent; (a pretty Income, truly!) pray, what was it? *Answ.* £16093 6 8 *per Annum.*

Sound, not interrupted, is found by Experiments to move uniformly about 69000 Feet in a Minute of Time; how long then after the firing off one of the *Tower* Guns may the same be heard at *Ewell*, taking the Distance at $13\frac{1}{8}$ Miles? *Answ.* $1\frac{3}{690}$ Minutes.

Again: If I see the Flash of a Piece of Ordnance fired by a Vessel in Distress at Sea, (which happens, suppose, at the Instant of its going off,) and hear the Report a Minute and 3 Seconds after, how far is she off, allowing for Passage of Sound, as before?

Answ. 13 Miles, 5 Furlongs, and 31 Poles, nearly.

If a Body weighs 20 Ounces upon the Surface of the Earth, what will its Weight be 70 Miles above it, taking the Earth's Diameter at 7970 *English* Miles?

Answ. 19 oz. $5\frac{31091}{637721}$ dr.

The less porous a Body is, the greater is its Density; now, the Moon's Density, or Compactness, is to the Earth's as $123\frac{1}{2}$ to 100; what Proportion then is there between the Quantity of Matter in the Earth and that of the Moon, since the Earth's Diameter is 7970 Miles, and

and that of the Moon 2170. *Answ.* $40\frac{117}{1000}$ Times more Matter in the Earth than in the Moon.

The Sum total of any Rank of Numbers not equally progressive, but multiplied from first to last by one common Factor, may be found by multiplying the last Term by the common Multiplier, and from the Product subtracting the first Term; divide the Remainder by the said Multiplier less 1, the Quotient is the Total sought.

On New-Year's-Day a Gentleman married, and received of his Father-in-law a Guinea, on Condition that he was to have a Present on the first Day of every Month for the first Year, which should be double still to what he had the Month before; what was the Lady's Portion?

Answ. £ 4299 15 0.

What is the Cube Root of 2? *Answ.* 1,26 nearly.

When a heavy Body is weighed in any Fluid, it loses therein so much of its Weight as an equal Bulk of that Fluid is found to weigh; suppose then a cubic Inch of Standard Gold in Air weighs 10 Ounces Troy, and that by Experiments; and a solid Inch of fresh Water is found to weigh 256 Grains; what will a gold Cup weigh, in Water, that raises a Fluid 2 Inches, in a Vessel 3 Inches square, when put into it?

10 oz. — $10\frac{2}{3}$ dwts. = 9 oz. $9\frac{1}{3}$ dwts. × 18 = 170 oz. 8 dwts. *Answ.* 170 oz. 8 dwts. in Water; in Air, 180 oz.

Two Ships set Sail from the same Port; one of them goes due East 90 Leagues, the other due North 70; how far are they then asunder? *Answ.* 114,01+ Leagues.

A Cone is 100 Feet in perpendicular Height, and the Base 20 Feet in Diameter; what must be the Length of a Ladder, fixed $7\frac{1}{2}$ Feet from the Edge of the Base, that will reach to the Top? *Answ.* 101,5+ Feet.

A Ladder, 50 Feet long, may be so placed, that it shall reach a Window 35 Feet from the Ground; on one Side of the Street, and without moving it at the Foot, it will do the same by a Window 25 Feet high on the opposite Side; the Breadth of the Street is required.

Answ. 78,004+ Feet.

What Quantity of Brandy will a Tun contain, that measures 50 Inches within at Head, 75 Inches at Bung, and is 150 Inches long; and how many Barrels of *London*

don Ale would fill it? *Answ.* 2337,4 + Gallons of Brandy; 59,8 + Barrels of *London* Ale.

A Lad, having got 4000 Nuts, in his Return was met by *Mad Tom*, who took from him $\frac{5}{8}$ of $\frac{2}{3}$ of his whole Stock; *Raving Ned* lit on him afterwards, and forced $\frac{2}{5}$ of $\frac{5}{8}$ of the Remainder from him; unluckily *Positive Jack* found him, and required $\frac{7}{10}$ of $\frac{17}{20}$ of what he had left; *Smiling Dolly* was, by Promise to have $\frac{3}{4}$ of what Nuts he brought home: How many then had the Boy left? what was his Share, and what *Dolly*'s?

Answ. $708\frac{48}{64}$ left; of which the Boy's Share was $\frac{1}{4}$, or $177\frac{3}{16}$; and *Smiling Dolly*'s $531\frac{9}{16}$.

A and B are on opposite Sides of a Wood 150 Toises about; they begin to go round it, both the same Way, and at the same Instant of Time; A goes 10 Toises in 2 Minutes, and B 16 Toises in 3 Minutes: The Question is; how many Times will they surround the Wood before the nimbler overtakes the slower? *Ans.* 15 Times.

What is the Difference in Weight between 18 cubical Inches of Gold, and 1 Gallon of Water, Wine Measure?

Answ. 4 oz. 16 dwts. more Weight in the Water.

Note. The cubical Inch of Gold is 10 oz. and the cubical Inch of Water 256 Grains.

The Number of Changes that may be made in n Things is $= 1 \times 2 \times 3 \times 4$, *&c.* to n Factors; thus it will be found that in 6 Things there may be made 720 Changes.

The Number of different Combinations of m Things in n Things is $= \frac{n}{1} \times \frac{n-1}{2} \times \frac{n-2}{3}$, *&c.* to m Factors; thus it will be found that there are 126 different Combinations of 4 Things in 9.

If one Agent, A, produce an Effect in the Time a; another, B, the same in the Time b; both the Agents together can produce that Effect in the Time $\frac{1}{\frac{1}{a} + \frac{1}{b}}$, *&c.* thus, if A can perform a Piece of Work in 10 Days; B the same in 13 Days; both working together can perform it in 5 Days $\frac{15}{23}$ Parts.

Multiply

Multiply 8 Feet 5 Inches by 4 Feet 7 Inches.

Answ. 38 Feet, 6 Inches, 11 Parts.

Three Merchants gain equally. A puts in a certain Sum for 6 Months; B's Time is $9\frac{1}{3}$ Months; and C's 14 Months; the Sum of the Products of the corresponding Stocks and Times is 1260: Required each Man's Stock. *Answ.* A's £ 70; B's £ 45; C's £ 30.

What Fraction of a Pound is the Difference of $\frac{3}{4}$ of a Guinea and $\frac{2}{3}$ of a Moidore? *Answ.* £ $\frac{9}{80}$.

What Fraction of a Moidore is the Difference of $\frac{4}{5}$ of 9s. 6d. and $\frac{5}{6}$ of $\frac{1}{2}$ a Guinea, increased by $\frac{6}{7}$ of a Pound, and lessened by $\frac{9}{10}$ s.? *Answ.* £ $\frac{821}{1260}$.

How many Pence are in $\frac{3}{4}$ of $\frac{5}{6}$ of a Pound?

Answ. 150 Pence.

What is the Square Root of 119550669121?

Answ. 345761.

What is the Cube Root of 8787727019456?

Answ. 20636.

Having caught a Fish whose Body is 42 Feet in Length, I find the Head to be $\frac{3}{7}$ of the whole Length less $\frac{1}{7}$ of this, and the Tail is $\frac{2}{7}$ of the whole Length more $\frac{1}{7}$ of this, I demand the entire Length of the Fish.

Answ. 98 Feet.

A Lady, being asked her Age, replied, if you multiply $\frac{3}{4}$ of Double my Age by $\frac{5}{6}$, and divide $\frac{1}{4}$ of my Age by $\frac{2}{3}$, the Sum of the Results will be 80 Years: What was her Age? *Answ.* 32 Years.

A young Man, being asked his Age, answered, that Double the Cube of $\frac{1}{2}$ his Age made 3456 Years: What was his Age? *Answ.* 24 Years.

The Sum-total of any Rank of Numbers, equally increasing, is found by multiplying the Sum of the first and last by Half the Number of Terms.

How many Strokes do the Clocks of *Venice*, which go on to 24 o'Clock, strike in the Compass of a Day?

Answ. 300.

If a Hole could be bored through to the Center of the Earth, and the Half-Diameter of this Planet were proved to be 3923 Times 5000 Feet, in what Time after the Delivery

Delivery of a heavy Body on its Surface would it arrive at its Center?

Answ. In 18 Minutes 27 Seconds and [illegible] nearly.

THE END.

ERRATA.

Page 9, Line 20, *for* Electaries *read* Electuaries.

Page 84, Line 18, *for* $\frac{1}{3}$ of mine *read* $\frac{1}{2}$ of mine.

—— 19, *for* $\frac{1}{6}$ of mine *read* $\frac{1}{3}$ of mine.

—— 20, *for* Father's 168, Son's 28, *read* Father's 105, Son's 21.

Page 92, Line 8, *for* 9565932 *read* 9565936.

—— 20, *for* 9565932 *read* 9565936.

—— 31, *for* 11. towards her Portion *read* 18.

Page 96, Line 24, *for* Numeration *read* Numerator.

Page 103, Line 31, *for* £ 100 *read* £ 200.

Page 118, Line 9, *for* [illegible] *read* [illegible].

Page 119, Line [illegible], *for* [illegible] *read* [illegible].

Page 120, Line 10, *for* 7300 *read* 7200.